Ogden College of Sciences & Engineering

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
2017- 2018

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COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Agriculture
College:	Ogden College of Science and Engineering

Program Name:	Agriculture, M.S.
Reference Number:	052
CIP Code:	010000
Degree Type (AB, BS, etc.):	M.S.
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The M.S. in Agriculture is a general degree in agriculture and can be thesis or non-thesis. In addition to Graduate School admission requirements, applicants should have an undergraduate major or area of concentration in agriculture or a related science. Non-agriculture undergraduate degree holders may be required to complete pertinent undergraduate courses in agriculture, as decided by the departmental graduate committee. Additionally, the Department of Agriculture requires: bachelor's degree in agriculture or related field, GPA of 2.75 or greater (on 4.0 scale), GRE general scores, three letters of reference, resume or curriculum vitae, and cover letter (i.e. statement of purpose) in which the applicant specifies the program to which they are applying (thesis or non-thesis), academic interests, relevant experiences, and a graduate faculty member in the WKU Department of Agriculture that has agreed to serve as the graduate advisor.

Degree Requirements (30 hours)

- Required Courses- 15 hours
  - AGRI 491G Data Analysis & Interpretation
  - AGRI 528 Agriculture Genetics
  - AGEC 561 Agricultural Production Economics (not required for thesis students)
  - AGRI 590 Experimental Design & Data Analysis
  - AGRI 598 Seminar (3 hours total)
  - 15 hours of Electives

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	11	18	12	27	29	19
Conferrals	5	4	4	4	4	6
SCHP	152	235	146	274	267	352

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

A number of cooperative research initiatives exist including but not limited to: the USDA Food Safety Grant, a cooperative project with faculty from SEAS and Sociology; USDA-ARS Animal Waste Management Grant, cooperators include several other STEM disciplines + the USDA-ARS units located in Bowling Green; a USDA cooperative grant between the Department of Agriculture and local farmers markets. Additionally, our Agricultural Research and Education Center (AREC) is the location for a number of cooperative projects including the Departments of Geology/Geography, Biology, Art, Engineering and Outdoor Recreation.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	3	33.3	4	75	7	100	1	100	16	75	82.2%
Progression											
150% Graduation Rate	2	50	3	33.3	4	25	7	57.1	1	100	73.3%
Time to Degree	2.92		5.33		3.00		3.17		3.17		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

(1) Students will demonstrate the ability to communicate effectively in the discipline; this will include written and oral presentations. Assessment of this core competency is achieved via the AGRI 598 course which is required for all Agriculture graduate students. Students are assessed by both the course instructor and other Agriculture faculty with respect to scientific abstract preparation and professional presentation skills; a standardized rubric approved by the departmental graduate committee is utilized to assess presentation skills. Graduate students are required to repeat this 1 credit hour course twice for a total of 3 credit hours during their M.S. program.

(2) Students will demonstrate the ability to gather evidence/data, interpret the data and substantiate their understanding of the data. Assessment of this core competency is achieved via the required AGRI 491G (Data Analysis and Interpretation) and AGRI 590 (Experimental Design) courses where graduate students assimilate pertinent information, statistically analyze it and interpret the results.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The department's student-centered approach lends itself to developing and sustaining professional relationships and communication between graduate advisors and M.S. students. Alumni feedback also contributes to our understanding of graduate success. Since the M.S. degree is not limited to any particular agricultural discipline, graduates enjoy a multitude of professional opportunities including doctoral programs and employment in governmental agencies and industry. Recent graduates of the M.S. program are currently employed in a widely diverse group of organizations including: North Carolina State Cooperative Extension Service, National Security Agency, Gaylord Opryland Hotel, USDA – Farm Service Agency, Walker's Bluff Winery, University of Kentucky Cooperative Extension Service, Southern Illinois University (Ph.D. candidate), University of Minnesota (Post Doctoral Researcher), Purdue University (Asst. Prof.), and UC-Davis (Asst. Prof.).

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Although we do not survey employers regarding their satisfaction with our graduates, our Agriculture Advisory Board does provide feedback. The board consists of a diverse group of Agricultural professionals well connected with the industry; thus, relevant examples of graduate successes and activities are communicated to the faculty.

Based upon the diversity of employment opportunities available, the department plans to revise the M.S. curriculum to allow for more curricular flexibility with regards to elective courses. This increased flexibility will allow graduate advisors to more specifically tailor coursework to the respective student's thesis research project.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)
The diverse nature of our program equates to excellent placement in graduate school and high employability/acceptance in the private sector.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					10	12
Number of NTE Faculty					4	4
Cost per SCH					$ 137	$ 128
SCHP/FTF by Dept.	384	428	443	385	358	375
% SCH by FTF by Dept.	90.7%	91.1%	94.7%	94.8%	89.0%	75.8%
Median Class Size by Level	3	5	2	3	4	8
% Under-Enrolled Sections by Level	100%	92.3%	100%	76.5%	78.6%	58.2%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

A number of revenue streams and corporate-university partnerships are associated with the M.S. in Agriculture program, with a revenue stream mean for the timeframe (FY14 – FY18) = $ 636,870. External monies include (but are not limited to) the following: USDA-ARS grants that promote the efficient and environmentally sustainable utilization of animal wastes, these funds have supported a number of graduate students over the past 15 years; Equine Trust Fund monies that support both graduate and undergraduate research in Equine Science; numerous corporate grant-in-aid and land rental funds supporting agronomic research, demonstration and educational initiatives on the AREC; and funds supporting market development of specialty crops.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The M.S. in Agriculture addresses each of the 3 components of the WKU Strategic Plan (our Students, our Hill, our Community and Beyond) by: (1) **preparing students for the global stage** via numerous **research and creative activities** inherent in M.S. coursework and thesis/independent study projects, (2) **enhancing critical thinking and problem solving skills** in our common core classes and in applied research activities, and (3) serving as **a regional lighthouse** for agriculture in our region by coordinating and cooperating with numerous industry personnel and governmental agencies on research initiatives designed to solve the numerous challenges that face 21st century agriculture.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The M.S. in Agriculture supports the Statewide Strategic Agenda's primary goals by (1) **increasing educational attainment** via offering both thesis and non-thesis seeking programs in traditional face-to-face and online course formats; this flexibility allows both full-time and part-time (employed) students to increase their (2) **workforce readiness** and create additional career opportunities for themselves. Additionally, the M.S. in Agriculture supports the (3) **research and innovation** goal by offering a thesis option and requiring both thesis and non-thesis students to successfully complete both a rigorous 15 credit hour core of courses steeped in research technique and data analysis and interpretation and a comprehensive capstone exam. An example of this is our custom online graduate program developed for Alltech.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The program directly addresses a significant need for individuals with bachelors or higher degrees to fill an estimated 57,900 jobs in the agriculture, food and environment disciplines (2015 – 2020 estimate). According to the *USDA's Employment Opportunities for College Graduates*, individuals with bachelors or higher degrees in the agriculture and food discipline are essential to accomplish national priorities regarding increases in food production, food security and renewable energy while simultaneously improving environmental quality. Advanced degrees awarded in Agriculture will assist in fostering a workforce capable of meeting these challenges. The program created a custom online graduate program to address work force needs for Alltech, a nutrition based company headquartered in Lexington, KY.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

An external review of our department was conducted in 2012 by professors from Iowa State, Oklahoma State and North Carolina State. The review summary indicated that our farm laboratory (AREC) provides "*opportunities for hands-on learning that have, by and large, been eliminated or much diminished at other institutions*." Departmental programs and initiatives established over the past decade were noted as "*help[ing] students respond to the changing agricultural environment*". Moreover, the reviewers stated, "*the agriculture faculty is universally respected for their openness and friendliness to students. This circumstance affords WKU an opportunity to offer one of the few remaining student-centered agriculture programs available*." Additionally, our long-standing cooperation with other departments on projects at the AREC (Depts. Of Engineering, Biology, Outdoor Recreation, etc.) continues to build important interdisciplinary relationships. Graduate students play a key role in assisting faculty with these educational and research initiatives located at both the AREC and on main campus.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The M.S. program should enjoy numerous opportunities in coming years. Opportunities include: (1) a recently established JUMP program should facilitate earlier recruitment of aspiring undergraduate students; (2) curricular revision should allow more elective course flexibility while maintaining academic rigor; (3) interdisciplinary opportunities exist, including potential collaborations with the WKU Mesonet, GIS program, and the Office of Sustainability; (4) additional online course offerings in the Agriculture Education discipline should be well received by high school Agriculture teachers. The Department has been approached by several companies located in KY to assist with continuing education and degree programs for employees. We have the opportunity to offer convenient, custom programs geared to address workforce needs.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The National Center for Educational Statistics reports a >38% increase in demand for Agriculture and Natural Resource graduates (Bachelors and Masters level) for the period 2009-2014. National data indicate M.S. conferrals in Agriculture increased approximately 5% from 2012 – 2015 while conferrals in our program remained steady, showing no significant growth or reduction. Recent increases in M.S. in Agriculture enrollment point to increased conferrals in the near future.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Our JUMP program was recently approved which will provide an avenue for students to complete an M.S. in Agriculture in 5 years. Curriculum revisions have been approved by the department and are ready to be submitted; these revisions should enhance students' progress toward degree by increasing curricular flexibility. A custom online graduate program was developed for a cohort of Alltech employees.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Although significant potential exists to expand the program, current faculty workloads do not allow for significant expansion of course offerings and/or student numbers. An online program suited to high school teachers should prove quite popular but may be limited by lack of faculty qualified to teach Agriculture Education graduate courses.
Curricular changes + the JUMP program should maintain or increase enrollment and/or progress toward degree (conferrals). In addition, further development of the Food Science curriculum should significantly enhance the program should FTF numbers be sufficient to facilitate this anticipated growth. The department has been approached by several companies located in KY to assist with continuing education and degree programs for employees. The food science portion of the program will need to expand to accommodate this workforce education opportunity.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)

☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

****Agriculture (with minor), BS REF# 605, cannot be differentiated from the Agriculture, BS REF# 508 program. There are zero courses or faculty devoted specifically to these programs. For the purpose of this review, these programs will be nested within the Agriculture, BS REF# 508 program as delineated in CAPE instructions to reduce unwarranted duplication.****

Department/School:	Agriculture
College:	Ogden College of Science and Engineering

Program Name:	Agriculture, BS
Reference Number:	508
CIP Code:	010000
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120 (50 in Agriculture)
List Concentrations (if any):	General Agriculture, Agribusiness, Animal Science, Dairy Science, Horse Science, Agronomy Plant Science, Agronomy Soil Science, Agriculture Education, Horticulture, Turf and Golf Course Management, and Pre-Veterinary

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Department of Agriculture strives to fill the needs of both the student who requires general technical knowledge for production agriculture and the student who needs more specialized training to pursue one of many careers. This is accomplished by offering specific curricula with enough flexibility to allow specialization within the curriculum.

Many students studying agriculture have urban backgrounds and lack farm experiences. The Department of Agriculture uses the Agriculture Research & Education Center as integral parts of its laboratory and classroom instructional program to provide practical experiences. Internships and cooperative work experiences are encouraged for all students.

Degree requirements:

- General Education requirements (as a part of or in addition to Colonnade 48-50 hours)
  - CHEM 105/106 or CHEM 120/121 **and** CHEM 107/108 or CHEM 222/223
  - BIOL 120/121
  - MATH 115 or higher
- Agriculture requirements (29 hours)
  - AGEC 160
  - AGMC 170/171
  - AGMC 176
  - AGRI 175
  - AGRO 110
  - ANSC 140
  - AGRI 291 or 491
  - AGEC 360 or AGMC 326 or AGR0 320 or ANSC 345
  - AGRI 397
  - AGRI 398
  - AGRO 350
  - AGRI 494
- Agriculture electives (21 hours)
- General electives to 120 hours

Department/School:	Agriculture
College:	Ogden College of Science and Engineering

Program Name:	Agriculture (minor required), BS
Reference Number:	605
CIP Code:	010000
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120 (30 in Agriculture)
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Department of Agriculture strives to fill the needs of both the student who requires general technical knowledge for production agriculture and the student who needs more specialized training to pursue one of many careers. This is accomplished by offering specific curricula with enough flexibility to allow specialization within the curriculum.

Many students studying agriculture have urban backgrounds and lack farm experiences. The Department of Agriculture uses the Agriculture Research & Education Center as integral parts of its laboratory and classroom instructional program to provide practical experiences. Internships and cooperative work experiences are encouraged for all students.

Degree requirements:

- General Education requirements (as a part or in addition to Colonnade 48-50 hours)
  - CHEM 105/106 or CHEM 120/121 **and** CHEM 107/108 or CHEM 222/223
  - BIOL 120/121
  - MATH 115 or higher
- Agriculture requirements (30 hours)
  - AGEC 360
  - AGMC 170/171
  - AGRO 110
  - ANSC 140
  - AGRI 291 or 491
  - AGRI 397
  - AGRI 398
  - AGRO 350
  - AGRI 494
  - Agriculture electives
- Minor/2nd Major (hours vary by program)
- General electives to 120 hours

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Agriculture, B.S. REF# 508						
Enrolled Students	339	367	400	382	363	89
Conferrals	52	57	60	64	75	22
SCHP	4,593	4,857	5,623	5,152	5,229	2,794
Agriculture (minor required), B.S. REF# 605						
Enrolled Students	39	42	33	30	31	89
Conferrals	15	11	9	11	7	22
SCHP	464	434	313	246	298	2,794

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The JUMP program for Agriculture was recently approved. This program should help feed students in to the M.S. degree. Additionally, the department offers two courses that meet colonnade requirements of the University, AGRI 108 and AGRI 280.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

As initially mentioned, REF#s 605, is nested for review within the REF# 508. Removal of any of these three programs would not reduce course offerings nor free up faculty to pursue other efforts.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
Agriculture, B.S. REF# 508											
First-Year Retention Rate	68	72.1	77	68.8	91	72.5	107	76.6	74	71.6	69.4
Progression			286	71.0	313	70.0	324	64.2	278	68.0	61.3
150% Graduation Rate	83	55.4	81	54.3	88	47.7	77	55.8	66	60.6	54.1
Time to Degree	4.69 (N=52)		4.61 (N=56)		4.02 (N=63)		4.14 (N=63)		4.10 (N=75)		4.39
Agriculture (minor required), B.S. REF# 605											
First-Year Retention Rate	5	80.0	8	75.5	7	57.1	9	33.3	7	71.4	69.4
Progression			31	80.6	26	73.1	20	70.0	25	76.0	61.3
150% Graduation Rate	5	60.0	11	63.6	12	33.3	2	100.0	5	80.0	54.1
Time to Degree	4.05 (N=15)		5.37 (N=11)		3.85 (N=9)		3.94 (N=11)		3.95 (N=7)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Students will be successful in an agricultural career field: Data from students enrolled in internship opportunities relevant to their future professions indicate a >97% employer/supervisor satisfaction rate in regards to their performance.

Students will demonstrate knowledge of diversity in agriculture production systems:
Students were introduced to a wide diversity of agricultural systems via enrollment in study abroad, study away and numerous production based courses. Domestically, study away courses traveled to numerous regions of the USA and production courses focused upon grain, forage, vegetable, grape, cut flower, turfgrass, hemp, cheese, beef, horse, and dairy production systems.

Students will demonstrate the ability to communicate effectively in the discipline via written and oral presentations:
All students are required to complete a Senior level seminar course in their particular discipline. Rubric data indicate > 97% of students performed at a "C" level or better during 2012 – 2018.

Students will demonstrate the ability to gather evidence for current issues pertinent to the agriculture discipline, make sense of the evidence, and substantiate their understanding of the issue:
Students enrolled in AGRI 494 (Contemporary Agricultural Issues) debate topics in a discussion based format. Topical evidence is gathered from various sources and opposing viewpoints are considered and discussed.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The department gathers data on interns from employer evaluations. Additionally, the department can track student acceptance into veterinary school and students passing the praxis for agriculture education. The USDA estimates 57,900 new jobs annually in the agriculture and food sector until the year 2020 with only having enough college graduates to fulfill 61% of these jobs. Of these new agriculture related jobs, 46% will be management and business, 27% science and engineering, 15% food and biomaterials, and 12% education, communication, and government services.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

In 2016, an Agriculture advisory board was formed from alumni and agriculture leaders within the State. This board meets with the department chair quarterly. Given the newness of the board and academic chair, little review of the academic program has yet taken place. The board has been instrumental in assisting the department in organizing alumni and the revival of the agriculture alumni association. Over the last two years, the department has averaged around 100 alumni in attendance at its homecoming event. Additionally, the board provided input and advisement on a name change for the department. This board's initial focus has been upon student recruitment and raising the profile of the department within the University and the State. The department does gather data in regards to employment through its Co-op courses. Employers of WKU students evaluate interns at the end of their employment. These reviews have predominantly been positive. Industry and governmental participation in the department's career fair and numerous inquiries to faculty and the department in general about potential employees gives an indication that graduates are in high demand. However, specific quantitative data is not available at this point.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					10	12
Number of NTE Faculty					5	4
Cost per SCH					$137	$128
SCHP/FTF by Dept.	384	428	443	385	358	375
% SCH by FTF by Dept.	90.7%	91.1%	94.7%	94.8%	89.0%	75.8%
Median Class Size by Level	13	15	17	16	16	19
% Under-Enrolled Sections by Level	54.5%	45.8%	35.9%	42.4%	48.4%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

A number of revenue streams and corporate-university partnerships are associated with the M.S. in Agriculture program, with a revenue stream mean for the timeframe (FY14 – FY18) = $ 636,870. A number of revenue streams and corporate-university partnerships are associated with the B.S. in Agriculture program. Examples of these would include: USDA-ARS grants that promote the efficient and environmentally sustainable utilization of animal wastes that have supported a number of students over the past 15 years, Equine Trust Fund monies that support both graduate and undergraduate research in Equine Science, numerous corporate grant-in-aid and land rental funds supporting agronomic research, demonstration and educational

initiatives on the AREC, and funds supporting market development of specialty crops. Additionally, funding is also supplied by the state to assist in the maintenance of the AREC. Finally, revenue is generated from the marketing of agriculture commodities produced at AREC.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The data provided the department of number of non-tenure track faculty is incorrect. Instead of 5, the department only had 4 this previous fiscal year. Lindsey Reynolds was counted in the original number, but she did not serve the department in this role in 17/18.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The B.S. in Agriculture addresses each of the 3 components of the WKU Strategic Plan (our Students, our Hill, our Community and Beyond) by: (1) preparing students for the global stage via numerous research and creative activities inherent in B.S. coursework and research/independent study projects, (2) enhancing critical thinking and problem solving skills in our common core classes and in applied research activities, and (3) serving as a regional lighthouse for agriculture in our region by coordinating and cooperating with numerous industry personnel and governmental agencies on research initiatives designed to solve the numerous challenges that face 21st century agriculture.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The B.S. in Agriculture supports the Statewide Strategic Agenda's primary goals by **(1) increasing educational attainment** via offering multiple concentrations that allows students the flexibility to increase **(2) workforce readiness and create additional career opportunities** to go back to the farm, start their own business, or pursue a career in the agriculture industry. Additionally, the B.S. in Agriculture **(3) expands regional partnerships** through internship placement and service outreach by faculty. During the 17/18 academic 64 students completed internships via Co-op courses. Many students choose to complete internships without registering for the Co-op course. Agriculture faculty serve on numerous statewide boards, councils, and other governing bodies as well as speak to commodity groups, agriculture teachers and students, and industry leaders. The department has a robust service/outreach effort. Metrics will be gathered on this in the future.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The program directly addresses a significant need for individuals with bachelors or higher degrees to fill an estimated 57,900 jobs in the agriculture, food and environment disciplines (2015 – 2020 estimate). According to the *USDA's Employment Opportunities for College Graduates*, individuals with bachelors or higher degrees in the agriculture and food discipline are essential to accomplish national priorities regarding increases in food production, food security and renewable energy while simultaneously improving environmental quality. Bachelor's degrees awarded in Agriculture will assist in fostering a workforce capable of meeting these challenges.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

An external review of our department was conducted in 2012 by professors from Iowa State, Oklahoma State and North Carolina State. The review summary indicated that our farm laboratory (AREC) provides "*opportunities for hands-on learning that have, by and large, been eliminated or much diminished at other institutions*." Departmental programs and initiatives established over the past decade were noted as "*help[ing] students respond to the changing agricultural environment*". Moreover, the reviewers stated, "*the agriculture faculty is universally respected for their openness and friendliness to students. This circumstance affords WKU an opportunity to offer one of the few remaining student-centered agriculture programs available*." Additionally, our long-standing cooperation with other departments on projects at the AREC (Depts. of Engineering, Biology, Outdoor Recreation, etc.) continues to build important interdisciplinary relationships

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The department recently changed its name from Agriculture to Agriculture and Food Science. Food science/safety are growing sectors within agriculture. This area could provide interdisciplinary connections with Biology, Public Health, and Engineering and Applied Sciences. Additionally, with advancements in technology and emphasis on sustainability, the precision agriculture field is rapidly developing. This area would provide interdisciplinary connections with Geography and Geology and Engineering and Applied Sciences.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to *DATAUSA*, a group of private companies with ties to MIT, the number of individuals with agriculture degrees in 2016 increased 3.4%. Over the past 5 years, B.S. degrees in agriculture at WKU have increase 7%. The *USDA's 2016* agriculture census showed that 13.6% of farm operators were women and 4% were minorities. WKU Agriculture's student population is approaching nearly 50% female. Minorities in the department are below the national average.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

As mentioned above, the department has recently changed its name to Agriculture and Food Science. Additionally, the department streamlined its general agriculture requirements within the major. This allows for more flexibility for agriculture students. Agriculture Faculty/Staff have always been active in student recruitment. University, college, and departmental student ambassador and college preview days are a couple of examples of University efforts in recruitment that have been modeled after long standing efforts within the department. Additionally, the department offers a four-day leadership workshop for high school seniors called ASSET and hosts an FFA field day that attracts around 700 students to AREC each year. These efforts have been sustained despite the reduction of faculty over the past ten years within the department.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Given industry trends and current lack of agriculture graduates to supply this industry's needs, growth potential in agriculture is high. Facilities associated with the department could utilize some updates, but are generally adequate and often superior to similar institutions. The greatest impediments are faculty/staff numbers and a dedicated agriculture recruiter. Over the past 10 years, faculty have declined from 18 to 14, yet student numbers have increased over this period. Through the agriculture extension system, the University of Kentucky effectively has agriculture recruiters in every county in KY. Additionally, Murray State employs a full-time recruiter to visit schools, attend state commodity meetings, and visit with high school FFA organizations and agriculture teachers. WKU Agriculture has a high success of getting students to attend WKU that visit the Department, AREC, and meet with faculty. However, there is no one to go out and invite and/or convince potential students to come and visit. Recruiting is currently accomplished by faculty in their 'spare' time and student ambassadors; with minimum funds supporting these efforts. Personal relationships are vital to be successful in recruiting agriculture students. The investment in additional faculty and in an agriculture recruiter would allow the department to take full advantage of this high growth potential.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Agriculture
College:	Ogden College of Science and Engineering

Program Name:	Agriculture Technology and Management, AS (#205)
Reference Number:	205
CIP Code:	010301
Degree Type (AB, BS, etc.):	AS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	60
List Concentrations (if any):	Turf and Golf Course Management and General Agriculture Options

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The turf and golf course management option is designed for individuals interested in becoming superintendents of golf courses, athletic fields and parks and recreational facilities, lawn care professionals, and cemetery caretakers. The course of study includes the care and growing of warm and cool season grasses, turf disease management, and equipment management and maintenance. The general agriculture option is designed to fulfill the needs of students primarily interested in the application of modern agricultural technology. Students enrolled in this program show interest in working with maintaining agriculture equipment and associated technologies or managing farming enterprises.

Degree requirements:

- General Education requirements (23 hours)
  - CHEM 105/106
  - BIOL 120/121
  - MATH 115 or higher
  - ENG 100
  - COMM 145
  - Arts & Humanities course
  - Social & Behavioral Course
- Turf and golf course management requirements (37 hours)
  - AGMC 170/171
  - AGMC 172/173
  - AGMC 270/271
  - AGMC 272/273
  - AGMC 371/372
  - AGMC 392/393
  - AGRO 110
  - AGRO 350
  - HORT 313
  - AGEC, AGRI, AGMC, AGRO, or HORT electives (10 hours)

- General agriculture requirements (37)
  - AGMC 170/171
  - AGRO 110
  - ANSC 140
  - AGEC 360
  - AGRO 350
  - AGRI 397
  - Electives 21 hours (minimum 12 hours must be agriculture)

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	10	7	7	9	4	26
Conferrals	2	3	2	5	4	9
SCHP	106	81	110	126	85	225

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This program can serve as a feeder program for the Agriculture B.S. degree. Courses required by the program are also courses required by the B.S. degree. Students uncertain about pursuing a college degree or a B.S. can enroll in the program and the decision of pursuing a B.S. can be made later without losing any credit hours obtained while enrolled in the A.S. program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	3	33.3	2	100	1	0	2	50.0	2	0.0	33.3
Progression			9	22,2	8	25.5	9	55.6	10	50.0	61.3
150% Graduation Rate	3	66.7	3	0.0	2	50.0	1	0.0	2	0.0	10.4
Time to Degree	4.5 (n=2)		2.44 (n=3)		2.67 (n=2)		2.73 (n=5)		1.75 (n=4)		6.13

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Students will be successful in an agricultural career field:
Data from students enrolled in internship opportunities relevant to their future professions indicate a >97% employer/supervisor satisfaction rate in regards to their performance.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Students graduating with an A.S. in Agriculture Technology with the Turf and Golf Course Management option have had a 100% job placement rate. The Bureau of Labor Statistics estimates an 11% increase in grounds maintenance jobs within the next seven years. This equates to 146,300 new jobs and is a growth rate considerably higher than the national average job growth rate for all sectors. Students of the turf program receive prestigious internships and are invited to work at Augusta National every year. Currently, only two other Universities are invited to send students to work at Augusta National.

Students of the General Agriculture option generally return to the family farm or work/manage other farms. The Bureau of Labor Statistics estimates a 6% increase in Agriculture and Food Science Technicians in the next 7 years. This equates to 1700 new jobs that require an Associate degree.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

In 2016, an Agriculture advisory board was formed from alumni and agriculture leaders within the State. This board meets with the department chair quarterly. Given the newness of the board and academic chair, little review of the academic program has yet taken place. The board has been instrumental in assisting the department in organizing alumni and the revival of the agriculture alumni association. Over the last two years, the department has averaged around 100 alumni in attendance at its homecoming event. Additionally, the board provided input and advisement on a name change for the department. This board's initial focus has been upon student recruitment and raising the profile of the department within the University and the State. The department does gather data in regards to employment through its Co-op courses. Employers of WKU students evaluate interns at the end of their employment. These reviews have predominantly been positive. Industry and governmental participation in the department's career fair and numerous inquiries to faculty and the department in general about potential employees gives an indication that graduates are in high demand. However, specific quantitative data is not available at this point.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Currently, calls and inquiries about students to fulfill full time employment and internships exceed the number of graduates with the golf and turfgrass management option of the program. The green industry (golf course, lawn and landscape, nursery, park, greenhouse, etc.) is desperately in need of employees to meet the needs of a growing industry.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					10	12
Number of NTE Faculty					5	4
Cost per SCH					$137	$128
SCHP/FTF by Dept.	384	428	443	385	358	375
% SCH by FTF by Dept.	90.7%	91.1%	94.7%	94.8%	89.0%	75.8%
Median Class Size by Level	13	15	17	16	16	19
% Under-Enrolled Sections by Level	54.5%	45.8%	35.9%	42.4%	48.4%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Because the A.S. cannot be separated from the B.S. program, revenue streams for the B.S. also help aid the A.S. program. A number of revenue streams and corporate-university partnerships are associated with the B.S. in Agriculture program, with a revenue stream mean for the timeframe (FY14 – FY18) = $ 636,870. Examples of these would include: USDA-ARS grants that promote the efficient and environmentally sustainable utilization of animal wastes that have supported a number of students over the past 15 years, Equine Trust Fund monies that support both graduate and undergraduate research in Equine Science, numerous corporate grant-in-aid and land rental funds supporting agronomic research, demonstration and educational initiatives on the AREC, and funds supporting market development of specialty crops. Additionally, funding is also supplied by the state to assist in the maintenance of the AREC. Finally, revenue is generated from the marketing of agriculture commodities produced at AREC.

A revenue stream that is specific to the A.S. program is funded through the Carl D. Perkins Career & Technical Education Act. These are federal funds designated to 2-year technical programs. Funding is based upon number of graduates from the program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The data provided the department of number for non-tenure track faculty is incorrect. Instead of 5, the department only had 4 this previous fiscal year. Lindsey Reynolds was counted in the original number, but she did not serve the department in this role in 17/18.
Additionally, students in this program are enrolled in the same courses as students in the B.S. program. There are no specific courses or faculty dedicated to this program. Removing the program would not result in fewer courses taught nor free up faculty to pursue other efforts.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The A.S. in Agriculture addresses each of the 3 components of the WKU Strategic Plan (our Students, our Hill, our Community and Beyond) by: (1) continuing education of the community by providing an alternative pathway to a degree other than a B.S. This pathway may be advantageous to non-traditional students, (2) developing shared intellectual capital through internships and partnerships with the green industry, and (3) improving the quality of life by providing educational opportunities for people in the industry.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The A.S. in Agriculture supports the Statewide Strategic Agenda's primary goals by **(1) increasing educational attainment** via offering multiple options that allows students the flexibility to increase **(2) workforce readiness and create additional career opportunities** to go back to the farm, start their own business, or pursue a career in the green industry. Additionally, the A.S. in Agriculture **(3) expands regional partnerships** through internship placement and service outreach by faculty. During the 17/18 academic 64 students completed internships via Co-op courses. Many students choose to complete internships without registering for the Co-op course. Agriculture faculty serve on numerous statewide boards, councils, and other governing bodies as well as speak to commodity groups, agriculture teachers and students, and industry leaders. The department has a robust service/outreach effort. Metrics will be gathered on this in the future.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

As mentioned earlier, the Bureau of Labor Statistics estimates and 11% increase in grounds maintenance jobs and 6% in Agriculture and Food Science Technicians within the next seven years across the U.S. The USDA reports agriculture commodity sales in KY over $5.5 billion dollars. UK Agriculture Extension (12-2015) reports Kentucky's green industry in 2013 directly supported 18,821 jobs and generated $1.12 billion in value added and $1.98 billion output impacts to the state's economy, based on direct output (sales) of $1.52 billion.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

An external review of our department was conducted in 2012 by professors from Iowa State, Oklahoma State and North Carolina State. The review summary indicated that our farm laboratory (AREC) provides "*opportunities for hands-on learning that have, by and large, been eliminated or much diminished at other institutions*." Departmental programs and initiatives established over the past decade were noted as "*help[ing] students respond to the changing agricultural environment*". Moreover, the reviewers stated, "*the agriculture faculty is universally respected for their openness and friendliness to students. This circumstance affords WKU an opportunity to offer one of the few remaining student-centered agriculture programs available*." Additionally, our long-standing cooperation with other departments on projects at the AREC (Depts. Of Engineering, Biology, Outdoor Recreation, etc.) continues to build important interdisciplinary relationships.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The department recently changed its name from Agriculture to Agriculture and Food Science. Food science/safety are growing sectors within agriculture that can provide employment opportunities for A.S. graduates and be a potential new market for students. This area could provide interdisciplinary connections with Biology, Public Health, and Engineering and Applied Sciences. With greater player safety concerns, a partnership with the School of Kinesiology, Recreation, and Sport may also be justified. Given that this a 2-year A.S. degree, opportunity for interdisciplinary connections are somewhat limited. Providing an online program to further the education of those already employed in the green industry may also be attractive to students.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to *DATAUSA*, a group of private companies with ties to MIT, the number of individuals with agriculture degrees in 2016 increased 3.4%. Over the past 5 years, B.S. degrees in agriculture at WKU have increased 7%. The *USDA's 2016* agriculture census showed that 13.6% of farm operators were women and 4% were minorities. WKU Agriculture's student population is approaching nearly 50% female. Minorities in the department are below the national average. Data specifically related to A.S. agriculture program trends are limited.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

As mentioned above, the department has recently changed its name to Agriculture and Food Sciences. Agriculture has always been active in student recruitment. University, college, and departmental student ambassador and college preview days are a couple of examples of University efforts in recruitment that have been modeled after long standing efforts within the department. Additionally, the department offers a four-day leadership workshop for high school seniors called ASSET and hosts an FFA field day that attracts around 700 students to AREC each year. These efforts have been sustained despite a reduction in faculty over the past ten years.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Given industry trends in golf course, sports turf, and lawn and landscape management and the current lack of agriculture graduates to supply these needs, growth potential in this area is high. Additionally, facilities associated with the department could utilize some updates, but are generally adequate and often superior to similar institutions. The greatest impediments are faculty/staff numbers and a dedicated agriculture recruiter. Over the past 10 years, faculty have declined from 18 to 14, yet student numbers have increased over this period. Through the agriculture extension system, the University of Kentucky effectively has agriculture recruiters in every county in KY. Additionally, Murray State. employs a full-time recruiter to visit schools, attend state commodity meetings, and visit with high school FFA organizations and Ag. teachers. WKU Agriculture has a high success of getting students to attend WKU that visit the Department, AREC, and meet with faculty. However, there is no one to go out and invite and/or convince potential students to come and visit. Recruiting is currently accomplished by faculty in their 'spare' time and student ambassadors; with minimum funds supporting these efforts. Personal relationships are vital to be successful in recruiting agriculture students. The investment in faculty and an agriculture recruiter would help the department take advantage of this high growth potential.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Architectural Sciences
Reference Number:	518
CIP Code:	151303
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The program in Architectural Science (AS) is designed to provide graduates with a practical architectural education combining an understanding of the philosophy of building design with an applied technical knowledge of construction systems and materials. Graduates are prepared with the knowledge and skills to assist in developing drawings and related documentation, constructing architectural models, developing architectural renderings, creating digital images and visualizations, preparing cost estimates and construction planning documentation, and making professional presentations. The teaching philosophy of this program focuses on project-based learning which is achieved by engaging students through hands-on class projects and involving students in faculty consulting and applied research activities. Real projects often serve as class projects. This program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The program is offered face-to-face. No minor, second major, or certificate is required.

AS students take the following supporting courses outside of the major in addition to Colonnade courses:

- AMS 140
- AMS 371
- AMS 390
- AMS 430
- CE 303
- ENG 306 or 307
- Approved economics or mathematics course

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	125	125	141	138	134	89
Conferrals	15	18	18	24	24	22
SCHP	1664	1790	2017	2092	1816	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

The program offers a required course (AMS 163: Architectural Drafting) to construction management, civil engineering, and manufacturing engineering technology programs. Some of the AS courses are also taken as electives by students in the interior design program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The construction management and AS program both support AMS 261/AMS 262 (Construction Methods and Materials), AMS 282 (Building Structures), AMS 305 (Building Codes), and AMS 325 (Survey of Building Systems). These courses rotate among faculty in both programs.

Faculty in the AS program also support the Engineering Technology Management graduate program through teaching courses as well as chairing and being members on thesis committees.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	26	65.4	17	76.5	21	85.7	17	78.9	25	64	69.4%
Progression	NA	NA	90	70.0	115	66.1	108	68.5	115	70.4	61.3%
150% Graduation Rate	15	20.0	17	52.9	16	62.5	29	51.7	24	54.2	54.1%
Time to Degree	4.38 (N=15)		4.35 (N=18)		4.43 (N=18)		4.34 (N=24)		4.10 (N=32)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of the assessment plan in support of ATMAE accreditation.

At the time of graduation, the students should have attained the following student learning outcomes (SLOs):

1. Graduates will be able to apply building codes, structure, HVAC, plumbing, energy conservation, and sustainable building practices. They will be able to determine appropriate materials and be able to observe building construction.

2. Graduates will be able to apply the architectural design process including schematics, design development, construction documentation production, and bid phase. They will have adequate verbal, written, and graphic communication skills for operating effectively in the construction environment.

3. Graduates will be able to solve architectural problems in terms of function, aesthetics, and constructability. They will be able to produce details controlling water, air, heat flow, sound, aging, and load transfer in terms of economics, ease of assembly, and efficiency.

4. Graduates will demonstrate the knowledge and capacity to apply managerial/ leadership principles and practices to appropriate situations

Industry professionals are invited to critique capstone projects as part of the assessment of plan. In May 2017, a number of the industry representatives found that students were not able to demonstrate the process of design which is a part of the schematic design phase. To correct this issue, the architectural science faculty have since implemented lectures and projects specifically targeting the design process in lower level design studios which provide students the knowledge and skills to apply in their capstone projects. Faculty who teach the capstone course have also implemented strategies to help students with the design process.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

As part of the ATMAE assessment process, graduates are surveyed each year regarding employment and/or progressing onto graduate/professional school. From survey results, most graduates have obtained jobs in fields directly related to their degrees and many were employed as soon as they graduated with some having obtained employment within six months of graduation. Starting salaries in 2014 were just below $30K but in 2018 starting salaries were close to $40K.

The key areas of professional opportunity for students graduating from this program are in the architecture, construction and engineering industry. Graduates also gain employment in landscape and interior design firms. City planning, zoning and code offices are also a very good professional avenue for AS graduates.

Some of the titles that AS graduates hold are architectural Intern, assistant designer, engineering and programming supervisor, service specialist, structural drafter, architectural technician, field engineer, project manager, and project designer.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the architectural science curriculum students are expected to undertake an internship. Employers are asked to rate students' performance on a Likert scale of 1-4. Over a period of four years it has been found that students have been rated positively in all aspects with a 3.7 average on overall performance on the job. The lowest has been a 3.1 on written communication skills. The focus of the AS program has been on verbal and graphic communication skill development. However, the faculty have implemented writing assignments in all appropriate courses based on feedback of employers. For example, in the capstone course students are expected to have a written booklet at the end of their project which states the goals of the project, the process, and a conclusion to the project.

In addition, as part of the ATMAE assessment process, employers are surveyed each year regarding satisfaction with our graduates.

The program also has an active advisory board that meets regularly to give feedback to the program. Employers were interested in the implementation of building information modeling (BIM) into the curriculum. This topic had been offered as an elective. Based upon the feedback from the advisory board, the curriculum was revised to make BIM a required course in the program.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Students in the program have been awarded FUSE grants and have successfully worked with faculty on these projects. Since the inception of the FUSE grants 8 students have been awarded FUSE grants. Three of these students have co-authored peer-reviewed papers with their faculty mentors. One paper was awarded the Best Conference Paper in 2012. In addition, students have been selected to present at Posters at the Capital in 2015 and 2018. Six students will be presenting in 2019. Seven students have received national recognition in the Design Communication Associations Juried Drawing Exhibition over the last few years.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3	12
Number of NTE Faculty					1	4
Cost per SCH					$144	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to a small foundation account that is shared by five programs. The average value over the past five years is $4,662. A former faculty member in the program ran an institute that employed students. This institute earned $131,355 over the past five years. However, the faculty member has retired and the institute is no longer active.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is insufficient to support the daily operations of the program. Course fees help with the sustaining of the program.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the AS program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, AS students learn to think critically and solve problems; thus, another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded, including a required capstone course.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves industry and community problems in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *AS students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Architectural science graduates often gain entry-level positions as designers, draftsmen and interns with architectural, construction and engineering firms. In addition, graduates also gain employment with city agencies, landscape and interior design firms and architectural product manufacturers.

According to JobsEQ, 9.0% of all industry in South Central Kentucky is in the sector of architectural, engineering, and related services. It is anticipated that the need for architectural and civil drafters has increased by 2.3% in the past five years.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The programs distinctiveness lies in the balance between knowledge-based and skill-based teaching and learning practices. AS core courses are lecture/lab, i.e. project-based courses. Emphasis is placed on the attainment of knowledge and the development of research abilities leading to the creation of socially, culturally and environmentally conscious designs and projects.

Murray State, one of the Kentucky benchmark institutions, offers a program in architectural engineering technology. Appalachian State University offers a building science program. While these programs appear similar, the program at Murray

focuses on the engineering aspects and at Appalachian State focus is mix of engineering, construction and design. The University of Kentucky's College of Design focuses on the design aspects and other programs in the region focus on drafting skills. The WKU AS program is uniquely focused on design and methods to create documentation for construction. These aspects make students very appealing to potential employers.

Faculty in the program come from culturally and professionally diverse backgrounds. There is a balance of practice-based and research-based faculty. Some faculty are licensed architects, LEED accredited professionals with substantial experience in the field of design and construction. This gives the students a great opportunity to learn how to create practical solutions during their course of study and develop critical skill set for their future career. The research faculty engage students in research related to disaster mitigation and post occupancy evaluation.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The architectural science program provides a balance between the design and the technological realm. The program provides students with the requisite knowledge of design and documentation thereby preparing them for graduate school and the workforce simultaneously. Architecture firms find AS graduates to be productive from the day they join their firm while graduate architecture programs seek AS students for their well-balanced knowledge and skills.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The architectural science program is uniquely poised to fill the void of emerging technologists in the architecture, construction and engineering (AEC) industries. In the past, AS graduates have gained employment as drafters in fabrication plants or furniture companies. Over the last few years, graduates have been successful in gaining employment in architectural firms such as FRCH, John William & Associates, and 906 Studio Architects. This is a great success for the program and an emerging market for graduate employers.

In terms of recruitment, the AS program needs more visibility in high schools around the region. Many students take drafting courses in their high schools but are unaware of the WKU AS program and thus do not pursue an architectural degree upon graduation. Within the School of Engineering and Applied Sciences, interdisciplinary connections can be made with the construction management program as well as the civil engineering program. This will provide opportunities for students to engage with disciplines that they would engage with in the professional field. Students will also benefit from connections with the interior design program at WKU.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The 2017 Architecture Faculty and Staff survey conducted by the American Institute of Architects (AIA) highlighted three trends/ issues in the field:

- technology,
- 21st-century challenges (urban planning, density, inequities, culture) and
- environment (climate, sustainability, resiliency).

The architectural science program is very well aligned to these trends and challenges through the curriculum. The curriculum focusses on providing students with education in digital technology beginning in the freshman year. Keeping with Industry trends, BIM was successfully adopted in the curriculum and virtual reality is being experimented through faculty research. Design studio projects focus on addressing challenges of density and inequities within the community and through the region. Students are provided the knowledge required to create sustainable communities and are rigorous in their application of sustainable technologies in their design projects. Students have worked with the City of Bowling Green to find design solutions for unused and unoccupied buildings helping create more sustainable options and prevent demolition of these structures.

The program has been steadily growing and currently the program has 120 students. There is a steady rise in job prospects and salaries for graduates from architecture and design programs. All of the AS May 2018 domestic students successfully gained employment in the AEC industry.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The faculty are continuously reviewing the program for improvement. A requirement of grades of 'C' or better grades in core technical courses was recently added to the program which has increased the quality of graduating students. New three-dimensional digital tools have been introduced into the classroom enhancing the student learning experiences and making students more competitive in the job-market. Also, a new physical studio space was recently added for the senior capstone students. The physical space helps foster a studio environment and creates a learning commons for the students. Due to budget limitations, computers could not be provided for the students. This limits productivity as student laptops cannot keep pace with the ever-changing technology.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
In five years, enrollment is expected to increase in the program due to the marketplace. It is also anticipated that faculty will increase research productivity. Thus, there is a need for increased faculty support as well as increased laboratory and research capabilities for the program. In ten years, the faculty would like to develop a NAAB (National Architectural Accreditation Board) accredited architectural Master of Science program while maintaining the undergraduate program. This will help serve the surrounding community as well as bring students from other states to WKU. Impediments that currently exist are lack of sufficient faculty and technology that would help enhance and grow the program.

e. What recommendation would you put forward for the program (check one)?	
☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Automation
Reference Number:	1726
CIP Code:	150613
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Ogden College
College:	OCSE

Program Name:	Biochemistry (majors)
Reference Number:	519
CIP Code:	26.0202
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	60
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

Biochemistry is the study of the chemical basis of living organisms. Training in biochemistry provides excellent preparation for students intending to enter health professions programs such as Medicine, Veterinary Medicine and Dentistry as well as graduate study in Biochemistry, Chemistry or Biology.

The Biochemistry major is administered by the Ogden College Dean's Office jointly with the departments of Biology and Chemistry. Students may enroll for Biochemistry courses through either the Department of Biology or the Department of Chemistry, depending upon their emphasis.

The curriculum of the Biochemistry major does not include any unique courses that are not already offered by the Biology, Chemistry, Agriculture or Physics departments. There is no unique prefix for the biochemistry courses, but are cross listed in both Biology and Chemistry. The Biochemistry major does not require a minor.

Required supporting courses include (in addition to the 60 semester hours): (PHYS 231, PHYS 232, PHYS 233, and PHYS 332) or (PHYS 255, PHYS 256, PHYS 265, and PHYS 266) and MATH 136.
There are no admission requirements for the major.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	52	49	55	59	65	89
Conferrals	12	9	3	14	6	22
SCHP	590	423	485	491	551	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

In 2015, the Medical College Admission Test changed its format and emphasis. In 2015 the "Biology/Organic Chemistry" section of the test became "Biological & Biochemical Foundations of Living Systems". Biochemistry became a highly recommended course for the MCAT, and in the last couple of years some medical schools (as well as dental schools) require Biochemistry coursework for admission. Biochemistry is critically important for the success of our Pre-Med Program.

BIOL/CHEM 446, BIOL/ CHEM 447 and BIOL/CHEM 467 are all offered for graduate credit (4xxG), thus contributing to the MS programs in Biology and Chemistry as well as the JUMP in Biology and Chemistry.

BIOL/ CHEM 446 are offered for Honors credit in both fall and spring, thus contributing to the Honors Program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Note: SCHPs were not provided by IR. Numbers were calculated from the enrollments in just 3 classes. BIOL/CHEM 446, BIOL/ CHEM 447 and BIOL/CHEM 467.

Enrollment in Fall 2018 for BIOL/CHEM 446 was 66 students, the highest in 5 years.

Conferral numbers are low as many Biochemistry majors switch their major to Biology or Chemistry as seniors. While the 60 hour major (plus 12 hours of required supporting courses) is a challenge, frequently scheduling required courses such as Biol 411, Biol/Chem 467, (both are only offered in the spring), is problematic.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	13	84.6	13	76.9	13	76.9	20	85	10	80	69.4
Progression			38	68.4	40	72.5	40	77.5	37	75.7	61.3
150% Graduation Rate	5	80	7	42.9	15	66.7	14	57.1	13	53.8	54.1
Time to Degree	4.31		4.15		4.00		4.55		3.73		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Biochemistry graduates gain a broad perspective of the chemistry of living things. As a major part of that they get a solid foundation in laboratory techniques and experimentation. The curriculum mandates a minimum of 11 laboratory courses with the typical student taking 13 or 14 laboratory classes. This prepares them well for laboratory technical jobs in industry, hospitals, food safety, etc.

Assessment of student success is through the monitoring of performance on professional school exams (MCAT, PCAT, DAT, etc.). Admission to professional and graduate school programs is also an indicator of quality. Roughly half of all biochemistry students are pre-health professions students with our recent graduates attending, medical, dental, pharmacy, physical therapy and veterinary schools.

In an effort to improve performance on professional school standardized tests, we offer a not for credit Interprofessional test prep class each spring. Dr. Kevin Williams, a Chemistry professor teaches the Biochemistry sessions in the test prep class. The class is typically taken by 30-35 students.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The Pre-Health Professions Advising Center in the Ogden College Dean's Office tracks all graduates applying to professional schools. The Biology and Chemistry Departments keep track of the exploits of biochemistry graduates through contact with the students by our faculty and staff. LinkedIn is an excellent resource for information about graduates in the workforce. For our 2013-2017 graduates, an impressive **66%** went on to graduate or professional school programs. Additionally, 13% are working in the field (lab technician, quality control), 5 % are self-employed, 5% otherwise employed, and 11% are unknown.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

We have not made a systematic effort to survey employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

While retention and progression rates are well above the Univ. values, 150% graduation rates are on a par with the University value. This is due to many Biochemistry majors switching their major to Biology or Chemistry as seniors. Frequently, scheduling required courses such as Biol 411, Biol/Chem 467, as both are only offered in the spring, is problematic.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.5+0.5=1	12
Number of NTE Faculty					0	4
Cost per SCH					$128	$128
SCHP/FTF by Dept.					545	375
% SCH by FTF by Dept.					N/A	75.8
Median Class Size by Level					21	19
% Under-Enrolled Sections by Level					57.1	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Faculty teaching in the Biochemistry major are members of the Biology, Chemistry, Agriculture or Physics Depts. Faculty teaching Biochemistry classes (Drs. B. Williams, K. Williams, M. Kim and S. Jacobshagen) are all grant-funded and research-active.

Each summer Biol/Chem 446 is offered on-line (18 enrolled in summer '18) or face-to-face. The DELO revenue goes to the department of the instructor of record?

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Lecture courses (Biol/Chem 446 and 467) have an average enrollment of 47 students. Biochemistry lab sections are capped at 12 students, thus the low median class size. These labs are nearly fully enrolled but fall into the Under-Enrolled Sections designation, thus the high percentage.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Our Students: Biochemistry is an attractive major for students looking for a career as a health care professional. It is a valuable alternative that allows the student to stand out from the majority of applicants (Biology or Chemistry majors).
The Biochemistry major attracts high achieving students (median ACT = 28).
As a major with no dedicated faculty it has little cost to the University, keeping education affordable.
We incorporate high impact practices (e.g., process-learning, collaborative learning and applied undergraduate research.
We schedule courses to maximize student progression and completion so students complete their degrees within ca. 4 years (Table 3a).
We have a number of biochemistry-related clubs (Chemistry Club, Alpha Epsilon Delta, Tri-Beta, Pre-Vet Club) that facilitate student growth in their disciplines.
Our Hill:
We increased fiscal resources through grants, expanded physical space on campus and enhanced virtual learning.
We maintain and acquired new laboratories and provide modern, diverse learning resources**.**
Our Community:
We offer courses on-line to enhance access.
We recruit, retain, and graduate a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

1: We partner with P-12 through outreach at WKU and on location for regional schools, and events such as Super Saturdays, Potter Gray Science Day, Science Olympiad.
2: We educate KY adult learners through online courses offerings.
3: We increase persistence and completion by setting minimum C-grade standards for introductory courses, intensive advising, implementation of high impact teaching practices, and by encouraging Gatton graduates to remain. Our students finished in 3.73 years (university average 4.39) last year.
4: We promote academic excellence through improvements in teaching and learning, including engaging students in the scientific process in laboratory courses.
5: We increase research through hands-on opportunities for our students to work with faculty.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

About 60% of Biochemistry freshmen are pre-health professionals, in one of nine pre-professional concentrations. We encourage those that won't enter professional school to pursue a biochemistry degree as the occupational outlook for medical and life science-related scientists and technicians is very strong. Through 2021, 33K additional medical practitioner and/or medical science support positions are projected for Kentucky. For our other students, the U.S. Bureau of Labor forecasts a 11% increase in the number jobs for biochemists (3,600 jobs) between now and 2026.
Per KYSTATS, many of the fastest growing jobs in Kentucky are in the realm of Healthcare Practitioner, Technician (very fast growing), and Healthcare support occupations (very fast growing). The biochemistry major prepares students to enter medicine and related fields. These students are supported by robust advising in the form of a pre-professional advising committees or specially trained advisors.
The Biochemistry major with its emphasis on hands-on learning in laboratory courses, prepares students well for work in clinical and industrial settings as laboratory technicians. Clinical and Medical Lab Techs are expected to see a 13% rise (42,700 jobs) over the next 10 years according to U.S. BOL.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

We offer frequent, dedicated Honors sections of BIOL/CHEM 446 to support our 33 (2018) Honors students (55% of all Biochemistry majors). Biol/Chem 446 is offered on-line in the summer. Biol/Chem 446 has been offered by an adjunct Instructor at the Owensboro Campus.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

WKU's Biochemistry major is the only UG Biochemistry major in Kentucky.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The massive projected growth in the health care industry predicts growth in pre-professional and related studies. The KY Cabinet for Health and Family Services has designated our entire region as a shortage area for health professionals and as medically underserved. The University of Kentucky College of Medicine has opened a campus in Bowling Green in an effort to ameliorate the shortage (fall 2018). Thirty students per year are matriculated in BG, this places the Biochemistry program in a good position to grow as more students in the region choose to pursue a career in medicine. The study of the chemistry of living things and its natural interdisciplinary nature (biology, chemistry, physics, agriculture, health sciences) should attract students in growing numbers.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The 20y trend for 4y degrees in STEM is strongly positive as the number of S&E bachelor's degrees awarded annually rose steadily from 398,602 in 2000 to 589,330 in 2012. Compared to the limited data provided here (2013 - 2017), the national trend over 2013-16 remains positive, while the WKU trend is relatively flat. With only 4 years of comparative data, no statistical comparison was appropriate.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Additional elective courses have been added for students in the Biochemistry major to allow more flexibility and for students to be able to better tailor the degree to their specific interests.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The Biochemistry program should continue to grow with the increased interest in STEM+H. In order to improve the program, additional faculty are may be needed to meet growing demand.

We should also adopt instructional technologies similar to those in professional schools (required tablets, real time recording of lectures for near-immediate playback, etc.). We have the ability to become a program of choice for biochemistry and pre-professional students in KY.

WKU far exceeds the other state universities as the choice for students moving from associate to baccalaureate programs (580 cp. to 369 at UK in AY15). We have the potential, given this statistic and the fact that several Biology and Chemistry MS graduates are faculty at regional technical colleges, to design and establish pathways to streamline and increase the progression of students interested in health-related studies from KCTCS schools to WKU Biochemistry.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Biology
College:	OCSE

Program Name:	Biology MS
Reference Number:	056
CIP Code:	260101
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
Graduate students study microbes to megafauna, genes to ecosystems, biochemistry to behavior, and all play an active role in the advancement of knowledge of the Department of Biology. Selection criteria include an undergraduate GPA of 3.0/4.0 and a minimum composite GRE of 300 (V+Q) and AW of 3.5, or the equivalent on the DAT (16+) or MCAT (20+). Foreign students must demonstrate English language proficiency by a TOEFL score (79+) or the International English Language Test score (6.5+). Three letters of recommendation and a student's statement of purpose are required. Thesis students must identify a departmental advisor prior to acceptance. Students complete 30 credit hours with a thesis or a non-thesis option for the Master of Science degree; the former conducting original research. Biology has a diverse array of faculty to attract a wide range of student interests. Typically, MS thesis students are residential while non-thesis students complete all or nearly all of their coursework online. Recently, the online option has grown to ca. 30 students. Thesis students on campus receive assistantship support and teach undergraduate biology labs, gaining valuable experience in instruction, course delivery, and classroom management. We also require them to complete teaching instruction modules (GATI).

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	49	42	30	30	34	19
Conferrals	16	21	10	14	12	6
SCHP	515	430	320	369	399	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

BIOL 400G-level courses allow graduate students to interact with senior undergraduates. There are approximately 11-12 400G courses offered over each 2-year cycle. A student can incorporate up to 12h of graduate credit from other departments or universities as approved by their committee in order to tailor the degree to the needs of the student.
We offer a JUMP program in which about 3 students participate per year. JUMP students interact closely with fellow undergraduate and graduate students, and provide important perspective to their undergraduate peers.
Graduate training involves MS students teaching some (BIOL 114, BIOL 131) or most (BIOL 121 and BIOL 123) of our freshman-level labs, plus some sophomore- (BIOL 225) and junior-level (BIOL 322 and BIOL 337) labs. This teaching experience is an important component of our graduate training. Graduates report back that teaching experience was critical to their professional development.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The actual number of MS students in Biology is higher than reported in table 2.a. We currently have 30 accepted online MS students. Not all of these students enroll in courses each term, as many are adult learners. This also makes our ratio of conferrals/student appear low, as these students take several years to complete and the recent surge in participation in the online program has yet to yield graduates. Thesis graduate students regularly present at professional meetings, receive internal and external grants, and publish. During the past 5 years, we have averaged 8.2 MS theses/yr.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	7	85.7	10	100	8	75	10	80	10	90	82.2
Progression											
150% Graduation Rate	13	61.5	7	71.4	10	100	8	75	10	70	73.3
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

First-year MS students enroll in BIOL 500 (Intro to Graduate Studies and Research), one section for thesis-track students and a second offering primarily for online cohorts. The course requires submission of a thesis/project proposal draft with literature review relevant to their research. Thesis students present a synopsis of their proposed research to the Biology Department faculty in a seminar. This is good for students, essentially providing a framework for remaining on task and not falling behind prior to the end of their first semester. Students also complete a preliminary comprehensive exam which we use to guide their coursework.

Thesis-seeking students must hold committee meetings each semester to track progress. Students that are teaching Biology laboratory courses are reviewed by both their peers and faculty each semester. This provides critical feedback from which they can grow as college-level instructors.

Outcomes for students in this program focus on producing new knowledge (e.g. via original research), as well as mastery of biological information and theory, critical thinking, problem-solving, and professional development. For thesis students, this is evaluated by content course work, comprehensive/oral exams, teaching reviews, and their thesis research. All theses are available online through Topscholar and approximately half of our students author or co-author one or more peer-reviewed articles. For our non-thesis students, outcomes are evaluated by course work, comprehensive/oral exams, and by their capstone experience (BIOL 516), which involves a research or intensive review project on a biological discipline, culminating in a substantial written product.

Our M.S. students receive formal professional development training in “soft skills”, including CV development, oral and written skills, abstract writing, grant writing, and development of poster and oral presentations that are given at professional meetings and in biology department seminars/symposia.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

We attempt to keep in contact with graduate students after they complete their studies. We are very successful in graduating students that have high acceptance rates into Ph.D. programs. From the most recent data from 2017, five students went into PhD programs, one is teaching, another is working as a data scientist while a seventh is working at a zoo. Only one student failed to complete the program.

Graduate students continue past WKU into several different arenas. Some proceed directly into Ph.D. programs or other professional degrees (e.g., Medical School). Others find employment in industry, NGOs, or governmental agencies. In recent years, several of our M.S. students have sought employment as full-time instructors at regional campuses in the Kentucky Community & Technical College System (KCTCS), where 4 are currently employed full-time. Some of these KCTCS instructors have since been elevated into tenure-track assistant professor positions with potential to earn tenure and further promotions.

Based on the postsecondary feedback report (2015), WKU ranks fourth of all KY universities in graduate enrollment, with 282 students coming to WKU to pursue graduate degrees and a relatively high proportion enrolled in the Dept. of Biology.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

We currently do not gather feedback from employers but based on anecdotal success of our students in finding employment in various sectors of the economy that hire life science graduates, we believe our curriculum is well aligned with societal needs. Most of our thesis program graduates choose to pursue PhDs or professional school.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Currently, SR Education Group ranks our online MS program 11th in the U.S. College Values Online rank us the 6th best deal nationally in online Biology degrees while the College Affordability Guide ranks us 21st.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR b. Values in red calculated based on allocation of 3 FTE to program	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3	12
Number of NTE Faculty					0	4
Cost per SCH					488	128
SCHP/FTF by Dept.					133	375
% SCH by FTF by Dept.					100	75.8
Median Class Size by Level	5	5	3	6	6	8
% Under-Enrolled Sections by Level	84.2	73.7	94.7	75	82.4	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

During the past 5 years, graduate faculty grant funding was: AY 13/14 ($1.7M), 14/15 ($1.2M), 15/16 ($1.5M), 16/17 ($1.9M), and 17/18 ($300K), from such agencies as NSF, NIH, USDA, and KBRIN. Thesis graduate students write grant applications for internal and external funds.

Two funding streams are critical for maintaining the program. WKU ARTP provides matching funds for Graduate Teaching Assistants mainly through the Biotechnology Center (BTC) and the Center for Biodiversity Studies (CBS). BTC and CBS graduate funds from ARTP have averaged $20,240 and $22,400 respectively over the last 5 AYs. These BTC and CBS graduate funds have provided partial stipend and partial tuition remission (annual average of $5,900 per student and 7.2 students). Biology has operated under an R1 model since the 1999 AY, in which trained GTAs teach basic labs. In turn, faculty have more time to pursue extramural funding, train and conduct research with undergraduate students, and work more effectively with more graduate students.

Because Biology annually offers several extended learning classes, DELO has provided funds to support 1-3 graduate teaching assistants. These funds decreased from 3 assistantships to 1 in the last 5 years, but we have not reduced our number of course offerings.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Biology also offers a new 15-credit hour Certificate Program (# 0493) for post-baccalaureate students requiring Biology credit hours, but not a degree, for training, promotion or accreditation. The Certificate Program is currently in its 3rd year and is successful with 14 admitted students. The courses chosen are typically those delivered in online format and are simply a subset of courses the on-line MS students take towards completion of their degree. Hence, Biology can efficiently serve two groups of on-line MS students based on need.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
Our face to face M.S. students are required to complete theses, which is one of the goals of the WKU strategic plan. These theses, in addition to peer-reviewed publications and presentations at local, regional, and national meetings all serve to increase the profile and quality of the University and its Graduate School. Our international reach via recruiting foreign grad students is helping WKU to create a dynamic and diverse university community. Moreover, some thesis research students conduct work abroad (eg. Kenya, Zimbabwe, South Africa) and these experiences enrich the WKU campus when they return. Research with foreign graduate students in their home countries enlightens faculty by giving them a world view and knowledge of international issues that trickle down to our undergraduate curriculum. Most research conducted by our thesis students has applied aspects.
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
Our graduate program fulfills many important goals such as: "Increase basic, applied, and translational research to create new knowledge, accelerate innovation, and promote economic growth." In particular, students in our non-thesis program are usually teachers or workers in biological disciplines, who receive advancement and promotion in their workplaces due to their M.S. studies and degrees conferred. Moreover, many of these students are supported by their employers, who recognize that the graduate education of their employees makes them more effective teachers and workers on the cutting edges of their respective disciplines.
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
The MS and now the graduate certificate program prepare students to enter high-growth occupations in KY, where the fastest-growing, highly paid jobs will require some form of continued education beyond high school. Over a fifth (20.6%) of these high-growth occupations require a Master's, Doctoral, or Professional degree. Hence the value of a graduate degree and one in the STEM as well is a valuable commodity in society today. Life Science occupations are predicted to grow by 6.4 % by 2026 (KYSTATS.KY.GOV, Sept. 2018).
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
Our program is distinctive in the broad range of faculty interests as well as involvement in national and international research efforts. Recent research has been undertaken throughout the USA as well as in Africa (Angola, Cameroon, Ghana, Guinea, Liberia, Kenya, South Africa, Zambia, Zimbabwe) and Costa Rica. We are nationally ranked as a top online Biology graduate program. Our students are multinational and have come from a wide range of countries, including India, Saudi Arabia, Ghana, Kenya, and Cameroon. These students mix and mingle with traditional resident Kentucky students, greatly fostering the exchange of ideas, cultural norms, and worldviews which contribute to the global perspectives of all our students. We have globally recognized experts in diverse fields, including insect systematics, animal behavior, ecology, physiology, and genetics who attract high-quality students from the region, the country, and the globe. Interests of WKU Biology faculty are broadly classified as Biotechnology (and the associated area of Bioinformatics) and Biodiversity. Faculty are members of one or more of the WKU Research Centers, most commonly the Biotechnology, Bioinformatics and Biodiversity Centers. We have the environmentally important Green River Preserve, site of several MS thesis projects, a 1600-acre reserve hosting 12 federally endangered species.
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)
Our online program allows us to reach adult learners across the globe, including active duty military personnel. With the elimination of the requirement for KY secondary teachers to pursue an MS degree, our new graduate certificate program in Biology, just instituted, should prove ideal for teachers seeking advancement but who do not wish to pursue a degree.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We see our program easily maintaining current enrollments, and considerable potential for increasing the number of online students. Students in STEM fields have a good outlook for employment in a variety of fields, including within the Commonwealth. Our online, non-thesis program is poised to recruit and accept a larger number of students who seek training and development in biotechnology, conservation and ecology, microbiology and food quality/safety, as well as science teachers from elementary to college level. Our new 15 h certificate has attracted attention to our non-thesis option and some of these certificate students may continue on for the MS degree. There are few fully online MS Biology programs, ours, as nationally recognized, has considerable opportunity for growth, if we can dedicate more faculty time to these courses.

Our program continually incorporates new advances in the field for training students, such as using next generation sequencing techniques and the use of the most modern microscopy techniques with our relatively recent acquisitions of transmission and electron scanning microscopes. Additionally we have our biotechnology and bioinformatics facilities with a wide range of equipment, including the High Performance Computing Center with its computer cluster.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

National trends show a continued rise in the number of MS degrees awarded (2013-2016: 13,964, 14,655, and 15,714). Our program saw a peak conferral of 21 (2014-2015), most recently 12 (2017-2018). At current rates, we expect our annual number of conferrals to range from 10-15 graduates/year, but with the increase of students, particularly on the non-thesis track, we see potential for strong growth in this area.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Within the past two years, our program has teamed with DELO to build web pages to attract more qualified applicants. This led to recent growth, particularly in our non-thesis track, that may not be evident in the current data. We also instituted new assessments to help these students plan their curricula. We developed a new Graduate Certificate Program which is attracting students that do not need a full graduate degree.

Our thesis-track M.S. program depends partly on allocation of resources in the form of Graduate Assistantships. In programs such as ours and around the country, students will not accept positions in programs without support in the form of teaching, research, or other assistantships (to include living stipend and tuition remission). These assistantship dollars are crucial to the maintenance and growth of our thesis M.S. program, and such funds are leveraged to a variety of positive outcomes for the students (high-quality education and research experience, including the production of original research, skills development and cohort-based camaraderie of the "graduate" experience), and the university (service to the department and college, SCH production by instructing biology laboratories, outreach and recognition for the university when students interact with other researchers, students, and the community).

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Given intelligent investment in faculty, our program will grow in the next decade. We can do this primarily in two ways. First, continued and improved advertisement of our non-thesis (online) track to potential students around the world. An increase in this area would likely necessitate a new faculty member in biology whose role would be professional oversight of the program and the students as part of their workload, as well as someone who can add to our course offerings in web-based graduate courses. Until 2016, we had a tenure-track faculty member whose responsibility in part was to oversee our non-thesis MS students; he departed and has not been replaced, which reduced our capacity to adequately manage this aspect of the program and its students.

Second, growing our thesis M.S. student body will require higher and more consistent levels of graduate assistantship support from the Graduate School or from Ogden College to compete in the graduate education marketplace. Moreover, we envision that certain incentives for faculty to recruit and mentor graduate students would also be necessary to grow that aspect of the program. This may include workload adjustments, merit compensation increase, or funding for travel to meetings and research.

e. What recommendation would you put forward for the program (check one)?

☑Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)

☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Biology
College:	OCSE

Program Name:	Biology majors
Reference Number:	617 (minor req.), 525
CIP Code:	260101
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	36/48
List Concentrations (if any):	A large majority of these majors are in the PVET, PMED, PDEN, PCHI, POPT, PPHA, PPHY, PPAS, PPOD advising concentrations.

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
There are two main Biology majors programs. Program 617 requires a minimum 36 credit hours of majors-level Biology coursework plus the completion of either a minor or a second major. Five supporting courses are required - CHEM 120/121, MATH 117 or higher, PHYS 231/232 or 255/256, plus two additional selections from a list of >20 courses. Students must include at least 3 upper-level Biology lab courses and a science process course. Program 525 requires a minimum of 48 credit hours of Biology coursework with additional courses as in 617, plus 2 additional Biology laboratory courses Students cannot proceed in either major without successful completion of the introductory majors sequence (BIOL 120/121; BIOL 122/123) with grades of “C or better” for all courses. Biology requires that students in both majors successfully complete an exit course (BIOL 489). Activities include development of a CV, participation in scientific seminars, and preparation of an alumnus action plan. This allows Biology to more easily and successfully track students’ post-baccalaureate pathways to provide the department with important data for internal and SACS reviews. Approximately 75% of entering freshmen are pre-professional, most take the 617 major with an appropriate minor, often Chemistry.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR, values in red calculated by dept. based on IR data	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	754	767	660	673	673	89
Conferrals	118	116	118	109	126	22
SCHP	6511	6821	5880	5852	5895	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

Enrolled students in 2.a. are the sum of the 617 and 525 programs. Bio students can enter our JUMP program. We teach BIOL 131 and 231, plus 207/208 in direct support of other programs, especially Nursing. We regularly (fall through summer) teach a high-volume, non-majors Colonnade lab course (BIOL 113/114) and three Connections courses (BIOL 380, 390, 392). Majors such as Agriculture (ANSC), Health Sciences, Kinesiology, and Psychological Sciences require BIOL 120/121. In spring 2018, > 50% of BIOL 120 students were not Biology majors. Most NTE faculty teach courses for non-majors, as do some TE faculty. Biology offers 12-13 400-level courses during 2-year cycles. All but one are offered in both 400/400G format.

Biology generated **20,214 SCHP** last year, second highest on campus. We are the best deal of any degree-granting unit at WKU in terms of salary$/SCHP. Our SCHP also highlights our importance to other units, as > 50% of our SCHP are in service to other units. BIOL 131 alone contributed 3068 SCHP in fall & spring of AY17-18. That is **3.1X the median in-department SCHP for the whole campus**. Absent the majors programs, this level of service would not be available to other units.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

These biology programs have the largest number of Honors students of any department by a factor of more than 2 (169 to Nursing's 73 in 2016). Our thesis graduate students serve as teaching assistants in 30-60 undergraduate labs per semester. GTAs are typically recent college graduates, provide a level of peer instruction, and serve as role models. They are required to complete GATI training.

3. SUCCESS OF STUDENTS

a. Data Provided by IR Data in red are calculated as sums or weighted (by enrollment) averages of the 525 and 617 programs.	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	201	75.15	210	83.37	227	74.45	164	78.03	212	72.65	69.4
Progression			536	65.47	528	62.71	485	68.45	484	64.32	61.3
150% Graduation Rate	190	58.46	173	51.44	186	52.65	175	59.97	199	61.31	54.1
Time to Degree	4.49		4.01		4.15		4.21		3.97		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

We expect students in both programs to develop broad biological perspective. We assess the knowledge of our students through monitoring performance on professional school exams (MCAT, etc.) and by an internal instrument based on the PRAXIS exam. Scores on this exam by graduating seniors rose from 61% in 2009-10 to 66% in 2017-18. To improve exam completion rate, we recently incorporated this into a required capstone course (BIOL 489).

We assessed the link between grades in our introductory majors sequence (BIOL 120, 121, 122, 123) and successful completion of the Biology degree and implemented a requirement that the students attain a grade of "C" or higher before progressing to higher coursework. We expect that this will increase our retention rate by assuring that students have a better understanding of foundational concepts before advancing.

To increase student learning and reduce student expenses, we entered an agreement with McGraw-Hill Higher Education to provide students in our freshman and sophomore classes access to their textbook and e-learning resources at a greatly reduced price. Studies on the efficacy of this intervention showed that low performing students and black students had the highest satisfaction with e-texts. Eighty-six percent of students had positive perceptions of the e-text when used with the e-learning materials. When these technologies were used with best practice pedagogy, student learning increased.

Biology recently introduced the requirement that Bio majors take at least one science process course. We have reorganized some courses and developed a new one, Biol 397, to accomplish this goal.

We noted that students were inconsistently prepared for entry to the job market in terms of basic job preparation skills, so we designed and implemented a new capstone course (BIOL 489 - Professional Aspects of Biology), which includes basic job skills (interviewing, CV preparation, lab safety training, etc.).

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

We track professional school acceptances through the Common Application System. One additional component of BIOL 489 (Professional Aspects of Biology) is that students are required to prepare an alumnus action plan. This enhances Biology's capacity to track student employment and successes following graduation.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As most Biology majors are in designated pre-professional concentrations, selected faculty pursue professional development to improve advising for and competitiveness of these students. For example, Dr. Ken Crawford and Dr. Michael Stokes visit professional schools and advising conferences. Because our successful students cited comparative anatomy as an important course for preparation for medical professional schools, we intentionally searched for replacement faculty who could teach that specific course during a recent search.

The DH does exit interviews with graduating seniors (170 interviews in the past two years) to determine their plans, obtain input on positives and possible improvements to our program and to try to maintain connectivity with our alumni.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)
These programs contain by far the largest number of Honors students of any department (169 cp. to 73 for the next highest in 2016). The metrics in this table (retention rate, time to degree, progression) are weighted (by enrollment) averages for 617 and 525 programs.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR in black, data in red modified to reflect FTEF designated by the Dept. solely to these 617/525 programs and SCHP generated by courses in these programs.	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					23 (16)	12
Number of NTE Faculty					5 (3)	4
Cost per SCH					85 (180)	128
SCHP/FTF by Dept.	559	583	554	618	639 (368)	375
% SCH by FTF by Dept.	85.9	92.8	84.5	91.4	91.7	75.8
Median Class Size UPPER Level	17	17	18	17	16	19
% Under-Enrolled Sections by UPPER Level	37.1	44.1	33.3	43.6	41	36.3
Other relevant data						
Median Class Size LOWER Level, majors courses, **incl labs, fall 2017**					36	modal bin 21-25
% Under-Enrolled (<20) Sections by LOWER Level, **incl labs, fall 2017**					18	

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Biology faculty regularly submit external proposals for grants and contracts with have achieved substantial success: AY 13/14 ($1.7M), 14/15 ($1.2M), 15/16 ($1.5M), 16/17 ($1.9M), and 17/18 ($300K). Sponsors include NIH, NSF and regional agencies like the KBRIN, KyEPSCOR, and KAS. Nearly all of these awards include funding for student researchers or employees. Many of these projects are applied in nature (cancer research, conservation of natural resources, hearing loss, sleep loss, etc.). We also receive donations to our departmental scholarships (16, some of which have multiple recipients per year), our Biology Undergraduate Research Fund, and the Biology Department Fund. We also have the Dr. Walter N. Scott Visiting Professorship that provides some support for short-term (ca. 1 semester) visiting scholar in the general area of physiology.

Other revenue streams contribute to the success of students in our undergraduate programs. For example, students take BIOL399/BIOL369 to conduct paid research or internships around the country (hospitals, universities, vet clinics, businesses, state/federal agencies, etc.). Several students are paid through the Biotechnology Center, Bioinformatics Center, and the Biodiversity Center funded through the Applied Research and Technology Program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Programs 617 & 525 essentially are Biology; nearly all our students are in these programs. All but one TE and 3/5 NTE faculty teach in these majors. The efficiencies of large, lower level classes in these programs allow us flexibility to meet the needs of a variety of students, and subsidize our other programs (any under-enrolled upper division classes have a maximum of 14 to accommodate field trips or lab facilities). The cost per SCHP @ $85 is the lowest for any degree-granting program at WKU. This provides an opportunity for Biology to hire and grow in strategic thrust areas.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- Our extensive international research and teaching programs exemplify global context.
- We had a dedicated general advisor and retrained faculty to be better specialist advisors.
- We maintain and acquired new buildings and extensive research land to provide modern, diverse learning resources.
- As the degree-granting unit with lowest salary/SCHP, we embody affordability.
- We actively promote sustainable practices (Green River Preserve, clubs) and efficient use of campus resources.
- We enhanced the Colonnade Program (BIOL113,114,120,121,122,123,131,207,208,372,380,390).
- We hired two pedagogical faculty to revamp our introductory majors courses and health-related non-majors courses. We are transitioning to active learning models.
- We incorporate high impact practices (e.g., flipped classes), immersive cultural learning (study abroad), process-learning, and collaborative learning and instructional opportunities.
- We schedule courses to maximize student progression and completion so students complete their degrees within ca. 4 years (Table 3a).
- We mandate scholarly activities and student mentorship in hiring, annual review, tenure and promotion, merit pay, and faculty workload decisions.
- We increased fiscal resources through grants, expanded physical space on campus and the Green River Preserve, and enhanced virtual learning.
- We have a number of biology-related clubs that facilitate student growth in their disciplines.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

We increase cultural competence at WKU through study abroad, research with students in several African countries, and local to global Colonnade Connections courses (Biol372, 380).
We partner with P-12 through outreach at WKU and on location for regional schools, and events such as Super Saturdays, Potter Gray Science Day, Science Olympiad.
We educate KY adult learners through robust online courses offerings.
Biology's extensive scholarships improve financial access for students.
We increase persistence and completion by setting minimum C-grades for introductory courses, intensive advising, implementation of high impact teaching practices, and by encouraging Gatton graduates to remain. Our students finished in 3.97 years last year.
We promote academic excellence through improvements in teaching and learning, including e-learning, process courses, and a new capstone course. We hired two pedagogical faculty to improve learning.
We improve career readiness by development of new Molecular Biotechnology major embedded within these programs. MBT has an embedded internship which gives students hands-on experience in a biotechnology work environment. We introduced a required professional skills course for our majors (Biol489).
We increase research through hands-on opportunities for our students to work with faculty. From 2016-17 to 2017-18, we increased the # of BIOL399 (research) students from 28 to 41.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

About 75% of Biology freshmen are pre-health professional, in nine preprofessional concentrations. We encourage those that won't enter professional school to pursue in a biology degree as the occupational outlook for medical-related scientists and technicians is very strong. Through 2021, 33K additional medical practitioner and/or medical science support positions are projected for Kentucky. For our other students, an additional 152 Biological Sciences secondary teachers will be needed and 1,383 new jobs are expected for other biological scientists (conservation biologists, botanists, epidemiologists, etc.). This is a good time to be a biology graduate and enter the workforce.
Per KYSTATS, many of the *fastest growing* jobs in Kentucky are in the realm of Healthcare Practitioner, Technician (very fast growing), and Healthcare support occupations (very fast growing). The department of Biology through its BS programs prepares students to enter medicine and related fields. These students are supported by robust advising in the form of a pre-professional advising committees or specially trained advisors. 59% of the 51 Bio majors who applied to professional school were accepted last year, 34/50 in 2016. Biology majors are a large majority of WKU's pre-medical students.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
We offer frequent, dedicated Honors sections of courses in the major to support our 169 (2017) Honors students at all UG levels. Common core courses with high demand are also offered in winter and summer terms, and several lectures are offered online, including BIOL 120 and BIOL 122. We supported Glasgow campus primarily with non-majors courses and freshman majors' courses; WKU/O with majors courses. We are well-known for offering popular skills-based, study abroad courses in support of our pre-professional students - for pre-med students in Kenya and pre-vet students in South Africa. We also support students in research for credit courses abroad, mostly in Africa, and our faculty are well known from guest appearances in the media. These features have made WKU the university of choice for some students. Our Genome Discovery and Exploration course coupled with our Bioinformatics course offers incoming freshmen an opportunity to engage in research that leads to student co-authored publication of their results. These, and other process courses in biology, give students opportunities to develop and apply problem-solving and communication skills. This program is part of the nationally recognized SEA PHAGES consortium and we have trained faculty and translated it into nine other Kentucky schools.
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)
These two programs along with the new molecular biotechnology major allow students to customize their program of study, and are thus very adaptable. We accept a number of support courses from such diverse departments as Agriculture, Architecture and Manufacturing Sciences, Chemistry, Sociology and Geology/Geography in order to make students more competitive for technical jobs.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
The massive projected growth in the health care industry predicts growth in pre-professional and related studies. The KY Cabinet for Health and Family Services has designated our entire region as a shortage area for health professionals and as medically underserved. We have already instituted a new major, Molecular Biotechnology, and adapted an old major, Medical Technology to a new, more modern approach, Medical Laboratory Sciences, to serve our students who veer from pre-professional studies or wish to work in healthcare technology or research, but not as a practitioner. Our flexibility in the majors allows us to serve other students, such as those planning to pursue graduate school or careers in environmentally-related fields. Our strengths in domestic and international ecological science, both aquatic and terrestrial, place us well to take advantage of the coming wave in research related to global climate change.
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
The 50y trend for 4y degrees in the biological sciences is strongly positive (coefficient of regression = 1547) and strong compared to the same trend for mathematics degrees (40) and the physical sciences (143). Compared to the limited data provided here (2013 - 2017), the national trend over 2013-16 remains positive, while the WKU trend is flat. With only 4 years of comparative data, no statistical comparison was appropriate.
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
In 2017, Biology hired a dedicated TE pedagogical professor (Dr. Mountjoy). Her task is to develop process-based learning models for our major's introductory courses, following a national trend in the incorporation of active learning and other high impact practices. We instituted a 'C' or better requirement for these courses before students can progress in the major. We have yet to have sufficient data to evaluate results. We also instituted e-texts and learning management systems for partial flipping of course content for both majors and non-majors introductory courses. Previously, in 2013 Biology hired a dedicated pedagogical professor (Dr. McDaniel) to redesign and refine two courses Anatomy & Physiology (BIOL 131 and BIOL 231) for pre-Nursing students. These lab revisions included the introduction of hands-on learning, case studies to enhance relevance,

and flipped portions of the lab. She evaluated and published the results of this experiment for non-majors in BIOL 131 that showed the revised pedagogy in the lab increased student learning. There was significant increase in the number of students earning Bs and Cs while the number of students earning Ds and Fs decreased.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

In order to improve these existing programs, additional faculty are sorely needed in pre-professional related areas, as we have recently lost faculty who taught such important preparatory courses as Comparative Anatomy, Parasitology, Immunology, the medical study abroad course in Kenya, Cell Biology, and Microbiology. We should also adopt instructional technologies similar to those in professional schools (required tablets, real time recording of lectures for near-immediate playback, etc.). We have the ability to become THE program of choice for pre-professional students in KY, especially those interested in global context in alignment with CPE's mission statement: to '...prepare students to create and apply new knowledge and excel in a global economy and culture…'

WKU far exceeds the other state universities as the choice for students moving from associate to baccalaureate programs (580 cp. to 369 at UK in AY15) We have the potential, given this statistic and the fact that several of our MS graduates are faculty at regional technical colleges, to design and establish pathways to streamline and increase the progression of students interested in health-related studies from KCTCS schools to WKU Biology.

e. What recommendation would you put forward for the program (check one)?

X Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Biology
College:	OCSE

Program Name:	Biology for Teacher Leaders, MAE
Reference Number:	#0442
CIP Code:	131205
Degree Type (AB, BS, etc.):	MAE
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
This program is moribund. We are recommending it be suspended.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
Science teachers in KY are no longer required to pursue a Master's degree, which was the original intent of this program. We have instituted a new certificate program to meet the needs of secondary Biology teachers.
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Chemistry
College:	Ogden

Program Name:	Chemistry Major
Reference Number:	623
CIP Code:	400501
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	33
List Concentrations (if any):	General, Foundations, ACS-Approved, Teacher

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

WKU Chemistry empowers students of all backgrounds to think critically about the molecular sciences and promotes a vibrant regional economy through training, public service, and industrial collaboration. We ignite a spirit of life-long learning through engaged classroom and laboratory instruction, hands-on experience in nationally recognized research, and direct mentoring by faculty. This enables our students to define their own career path and to make an impact both locally and globally.

The major in chemistry leads to a Bachelor of Science degree and requires selecting one of the four concentrations described below. A second major or minor or the American Chemical Society (ACS) Approved Concentration is also required. MATH 136 and PHYS 255/256 (or PHYS 231/232) are required support courses for all concentrations. The *ACS-Approved Concentration* is primarily for students that will become practicing chemists, and includes additional cognate coursework: MATH 137 and PHYS 255/256 (or PHYS 332/233). The *General Chemistry Concentration* is typically for pre-health profession students pursuing a double major. The *Foundations Concentration* includes a wider breadth of chemistry coursework for students that prefer to complete only a minor. The *Teacher Certification in Chemistry Concentration* requires a SMED major, and additional support courses PHYS 332/233 and GEOL 111/113.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	194	194	167	164	148	89
Conferrals	52	47	29	39	47	22
SCHP	1621	1461	1449	1427	1270	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

In today's technology-driven world chemistry is commonly referred to as "The Central Science." Chemistry plays an important role in the research, development, and quality assurance of products and materials ranging from pharmaceuticals to nanocomposites. Knowledge and understanding of fundamental chemical concepts are crucial for success in a wide variety of disciplines, including agriculture, engineering, health and life science, physical science, and science education. Many academic programs within Ogden College require coursework (5-20 hours) from the chemistry major program. This includes degree programs in biology (ref. numbers 525, 617, 738), biochemistry (519), civil engineering (534), geology (675-karst concentration, 577), and physics (754). The program's general chemistry lecture/lab courses (10 hours), and quite often the organic chemistry lecture/lab sequence (10 hours), are staples for pre-health profession curricula, including chiropractic, dentistry, medicine, optometry, pharmacy, physical therapy, physician assistant, and veterinary medicine. There are also many programs across the University (e.g., within agriculture, SEAS, science education, allied health, applied human sciences, and nursing) requiring chemistry coursework that can be selected from either the chemistry major program or from the Department's specialized service courses. The latter courses are often taught by faculty that also teach courses for majors.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The estimated SCHP for AY 2017-18 in the category of service coursework (i.e., excluding SCHP for declared majors and minors) in both major and non-major courses is nearly 9,500 hours and comprised approximately 79% of the Department's total SCHP (roughly 12,000 hours) that year.

The ACS-Approved concentration is also the undergraduate pathway in the Chemistry JUMP (one of the first at the University), which has grown to consistently have 2 to 3 students per class generation and has graduated five JUMP students over the last two years.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	48	75.0	30	70.0	46	80.4	37	78.4	31	83.9	69.4%
Progression			137	70.1	134	63.4	124	79.8	112	73.2	61.3%
150% Graduation Rate	56	60.7	60	53.3	54	64.8	52	69.2	47	63.8	54.1%
Time to Degree	4.05		4.15		4.15		4.12		3.80		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The Department of Chemistry is approved by the American Chemical Society (ACS) to certify that degree candidates satisfy the curriculum requirements established by the Society's Committee for Professional Training (CPT). Learning objectives for the program are designed around ACS-CPT guidelines, which designate standards for introductory, foundation-level, and in-depth coursework as well as laboratory experience, cognate coursework, and skills development in lab safety, scientific information management and communication, teamwork, and professional ethics. ACS-CPT guidelines are fully satisfied for students that complete the *ACS Concentration*, however, the *Foundations*, *General Chemistry*, and *Teacher Certification in Chemistry Concentrations* share common course requirements, especially at the introductory and foundational levels.

For chemistry majors, the primary objective of introductory chemistry is to prepare students for foundation-level coursework, which requires knowledge and proficiency in the use of basic chemical concepts and laboratory skills. The Department administers an exam in CHEM 120/121 (E-NS/SL) to evaluate a set of these outcomes that have also been designated as the Colonnade learning objectives. Likewise, the ACS produces a nationally standardized general chemistry examination, which is administered in CHEM 222, and is a component of the Department's Action Plan/Year-End Progress Report to Academic Affairs. Foundation-level and in-depth coursework is divided among the five traditional sub-disciplines of chemistry (analytical, biochemistry, inorganic, organic, and physical). The ACS-CPT provides guidelines and learning objectives for each sub-discipline that are assessed by various combinations of sub-discipline specific ACS exams and/or other instruments (e.g., homework assignments, quizzes, exams, and projects) developed by individual faculty.

In 2015 the Department's Undergraduate Program Committee performed a benchmark study and comprehensive review of the undergraduate degree program. This activity led to major curricular revisions over the last three years, which included modifying the general chemistry placement criteria, course prerequisite/co-requisite revisions, the creation of a new concentration (Foundations), and additional support course requirements.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The Department maintains a list of graduates that is annually updated with new information received by academic advisors and research mentors. The Department's Communication & Development Committee maintains a social media presence that is also used to stay in contact with alumni. Over the last three years the Department has been able to track 72% of its graduates; 29% are confirmed to have progressed onto professional schools, 18% have pursued graduate studies, 25% are confirmed to have entered the workforce.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Visitors from industry and academic institutions regularly give presentations in the Department's seminar series. Students and faculty meet with these speakers to discuss a variety of topics, which often include educational and career opportunities (i.e., recruitment). These interactions provide valuable feedback that informs and enriches the academic experience of the program's students and faculty. Students and faculty also attend professional meetings to stay informed on recent advancements in chemical science. This provides many benefits within the Department, including to the program, especially with respect to advising and mentoring students in their professional development. For example, having a faculty member attend the biennial Kentucky Premedical Advisors Conference informs the Department on how the program can best serve its pre-medicine students.

As part of its approval process, the ACS-CPT provides periodic feedback to the program, and as such can be regarded as an advisory board that aims to ensure that undergraduate education is responsive to new trends and priorities in chemical science. For example, the ACS-CPT recently added a new polymer/macromolecular content requirement to its curriculum guidelines. The Department reviewed the curriculum and determined that the program already provides adequate coverage of those topics, and is in compliance with the amended guidelines.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					4.02 (of 15)	12
Number of NTE Faculty					0.08 (of 4)	4
Cost per SCH					$213 ($101)	$128
SCHP/FTF by Dept.	495	548	578	618	518	375
% SCH by FTF by Dept.	96.4	98.0	95.4	92.9	86.7	75.8
Median Class Size by Level	20	16	13	18	15	19
% Under-Enrolled Sections by Level	42.0	47.9	56.8	40.4	42.2	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Research grants from both state and federal funding agencies are the primary external revenue stream associated with the program. Departmental totals for the last three fiscal years are as follows: FY16 $772K, FY17 $1,018K and FY18 $666K. Funds from these awards are allocated for various purposes, e.g., to purchase research equipment and supplies, to provide summer salary/benefits for faculty, and to provide wages/benefits for graduate and undergraduate research assistantship positions. Between Fall 2016 and Fall 2018, Departmental research awards have been used to support at least 31 individual students (both graduate and undergraduate). Still many other students participate in these externally funded research projects, as well as other unfunded research projects, on a research-for-credit basis through the program's CHEM 299 and 399 courses.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Maintaining the Department's academic laboratories involves significant cost (over $85k per year), which is largely recouped through laboratory course fees. The Department's faculty and staff minimize these costs and fees by designing microscale laboratory experiments that reduce the volume of reagents used and the amount of chemical waste produced. Likewise, whenever possible, experimental protocols are developed to use reagents and so-called "green" solvents that minimize environmental and safety hazards.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The program's general chemistry courses can be used to fulfill the E-NS/SL component of the Colonnade program (Our Hill, SG 3.19). As described in Section 3(b) of this document, the curriculum meets the standards of the ACS-CPT, giving both a benchmark of quality and level of standardization toward a common intellectual experience for both major and non-major students (Our Students, SG 5.12). The program is designed to ensure that students have every opportunity to grow as scientists and scholars, to develop independent critical-thinking and problem-solving skills, and are prepared to enter the workforce on the regional and global stage (Our Community, SG 1.4). As students progress through the program, they have direct and sustained interaction with professors conducting novel research. Many chemistry majors complete independent research projects supported by faculty mentors (Our Hill, SG 4.). While pursuing their studies, students take advantage of the program's state-of-the-art laboratory facilities starting with their first chemistry class on the Hill (Our Students, SG 5.13).

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

As described in Section 3(b) of this document, the Department uses a combination of faculty-designed assessment instruments and nationally standardized exams to evaluate student learning, which inform both pedagogy and curriculum review (Objective 8.1). The Department assists students in their career development and ensures their success through the faculty's teaching, advising, and mentorship activities (Objective 9.1). The latter, in particular, most commonly involves opportunities for undergraduate students to conduct or assist in research projects (Objective 10.4), which in turn provides students with hands-on laboratory experience and valuable real world problem-solving skills.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The program's majors often progress onto graduate school with the intention of becoming practicing chemists or will pursue professional studies, e.g., pharmacy and pre-medicine are common. Another portion directly enters the regional workforce. According to the (federal) Bureau of Labor and Statistics Occupational Outlook Handbook, there are an estimated 660 chemists employed in Kentucky with a median salary of $67K. The projected percent change in employment of chemists and materials scientists (nationwide) from 2016 to 2026 is 7%, which is as fast as the average rate for all occupations. There are an estimated 4,840 pharmacists employed in KY with a median salary of $121K. The projected growth rate between 2016-2026 (nationwide) for pharmacists is 6%.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

Across the country, undergraduate chemistry programs that meet the ACS-CPT guidelines are essentially standardized by design, at least in terms of curriculum. The undergraduate chemistry program at WKU offers traditional classroom and laboratory experiences that are enhanced through high impact practices and strong student-faculty interactions at both the lower and upper levels. Likewise, students have access to state-of-the-art facilities and modern instrumentation for performing chemical and physical analyses. Many undergraduate chemistry majors actively participate in research projects with a faculty mentor. These students gain valuable hands-on experience and commonly present their work at statewide, regional, and national research conferences, and are co-authors on scholarly publications in internationally recognized scientific journals.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

A strong understanding of basic chemistry concepts is important for success in many branches of physical and life science, and in some technology disciplines as well. In particular, the chemistry program is aligned with the prerequisite coursework and entrance examinations required by many health professional schools. Such pursuits attract a fairly steady stream of students, and so demand for the program's general and organic chemistry courses is expected to at least keep pace with, if not outpace, enrollments in the College. For example, the number of students in CHEM 120 has increased by about 33% over the last three years.

Undergraduate students that major in chemistry, or that add chemistry as a second major, are often able to distinguish themselves through their academic performance, and in many cases through faculty-mentored research activities, which in turn, makes their graduate or professional school applications quite competitive. Finding effective ways to market the Department's strong record of preparing talented students will continue to be an important opportunity for the program in the years to come.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Over the last two decades (1997-2018), the program has produced a median of 47 BS degrees per year. Between 2009 and 2012, the program enjoyed a rather dramatic surge in the number of majors and degree conferrals. Since then, the number of majors has fallen and even dipped below the median baseline, e.g., only 29 degrees conferred in 2016; however, the two most recent academic years have shown some recovery, with 39 and 47 degrees produced in 2017 and 2018, respectively.

For the most recent data available from the American Chemical Society (2012-2013), the WKU Chemistry Department ranked 13th (out of over 450 schools) in the nation among non-PhD-granting programs in terms of BS degree production with 46 graduates. When including the PhD-granting programs, the rank was 65 (out of over 700). This puts WKU Chemistry easily in the top 10% of all Chemistry Departments by this criteria and in the top 3% of predominantly undergraduate institutions.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The Department has completed a comprehensive internal curriculum review and revision within the last two years. The bulk of these changes were designed to make the program more rigorous and to increase the number of students electing to pursue the *ACS Concentration*. For example, the minor requirement for the *ACS-Approved Concentration* (53 hours of CHEM coursework) was eliminated, and a new *Foundations Concentration* (37 hours of CHEM coursework) that requires a minor was added to the program. Likewise, our *General Chemistry Concentration* (33 hours of CHEM coursework) was revised to require a second major, whereas it previously required only a minor. Most of the Department's courses were revised to require a grade of "C" or better in all prerequisites, and the required prerequisites were modified for several 400-level courses. Cognate coursework in both mathematics and physics is now required for all concentrations. Cumulatively, these revisions provide a structure that will enhance the overall quality of training received by all Chemistry majors.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

A reasonable goal over the next 5-10 years is to have a reputation for being the best undergraduate chemistry program in the state. In terms of total chemistry degree production, the program at WKU has led the state for many years. However, it is important not to be complacent, and to continue investing in recruitment, advising, and other strategic initiatives that will capitalize on the program's many positive attributes, i.e., a robust curriculum, strong faculty-student interactions, state-of-the-art facilities, excellent research and career opportunities. Perhaps more important, is the program's reputation for the quality of its curriculum and the professional opportunities afforded to its students. This can be measured in part by the relative number of ACS-certified graduates, and recent program revisions have made it feasible to "up-grade" a larger proportion of students to this track over next 5-10 years. Other aspects of the program's reputation are the involvement of students in meaningful research experiences and the success rate for students in finding positions in graduate/professional school or the workforce. The Department is already strong in this respect but needs to develop more effective ways of measuring and marketing these opportunities to attract talented students from around the service region.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Civil Engineering
Reference Number:	534
CIP Code:	140801
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	129
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The mission of the WKU Civil Engineering (CE) program is to prepare students for professional engineering and management positions in all phases of civil engineering projects. The program provides a broad educational background with a foundation in basic engineering and business principles. The program focuses on construction, geotechnical engineering, construction materials, structures, surveying, and hydrology. The teaching philosophy of this program focuses on project-based learning which is achieved by engaging students through hands-on class projects and involving students in faculty consulting and applied research activities. This program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The program is offered face-to-face. No minor, second major, or certificate is required.

CE students take the following supporting courses outside of the major in addition to Colonnade courses:

- MATH 136,137, 237, 331
- PHYS 255/256
- CHEM 120/121
- GEOL 111/113
- AMS 163

Students are also required to choose elective courses which may be outside of the program. Students are admitted as a Pre-Major in CE. In order to transition from Pre-Major to Major, student must satisfy the requirements below. All courses below must have a grade of "C" or better.

- ENG 100
- COMM 145
- MATH 136
- MATH 137
- PHYS 255/256
- GEOL 111
- EM 222

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	191	222	220	211	198	89
Conferrals	24	20	37	27	30	22
SCHP	1773	1993	2277	2371	2596	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

This program offers courses (CE 160/161, CE 303, and CE 316) that are required for construction management and architectural science students. All faculty in the program also participate in the multi-disciplinary senior project course sequence by sponsoring teams of students to solve real-world problems.

Any student can enroll in the CE pre-major regardless of preparedness to be successful in the major. There is a significant number of students who declare CE as a pre-major that will change majors due to the math and science rigor required in the freshmen and sophomore year classes. The fluctuation in enrolled students shown in the table above was due to a large influx of international students into the pre-major several years ago. However, the SCHP has remained high which indicates a large and stable number of students in the major.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Successful engineering graduates must be able to use the foundation in engineering problem solving to grow in the profession to meet the demands and challenges of the rapidly changing technological landscape. To meet this need, the CE program has a long history of offering engineering education where students can engage in a wide range of projects while learning the fundamentals of civil engineering. The program has many lab and project intensive courses that impacts the class sizes offered.

Faculty have high loads during the normal academic year and typically offer summer and winter courses to meet the enrollment demands in construction management, architectural sciences, and civil engineering.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	38	73.7	53	88.7	47	74.5	42	88.1	49	73.5	69.4%
Progression	NA	NA	172	52.9	164	65.9	149	67.7	152	63.2	61.3%
150% Graduation Rate	27	51.9	35	57.1	33	57.6	36	58.3	38	60.4	54.1%
Time to Degree	4.10 (N=24)		4.07 (N=19)		4.35 (N=37)		4.42 (N=27)		5.31 (N=30)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of an assessment plan in support of ABET (www.abet.org) accreditation.

The program faculty developed the following student learning outcomes (SLOs) to prepare graduates to enter the professional practice of engineering:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

The program uses a variety of rubrics and other tools to assess these SLO's in support of the ABET assessment plan. The program then uses the results from this assessment to create an action plan to improve the program.

For example, the Fundamentals of Engineering (FE) exam scores were below the national average in Fall 2018. From the FE exam, SLOs (1), (2), (4), and (6) can be assessed. It was determined that a review course should be offered for students and additional content should be covered in appropriate courses.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Civil engineering students have multiple opportunities upon graduation. Most graduates are employed in the South-Central Kentucky region after graduation. Several students have also pursued graduate degrees after graduation.

To support graduate employment, a part time industrial liaison disseminates job and internship opportunities and assists students in development of professional skills such as resume writing and interviewing. Since the liaison began working at WKU in May 2017, she began surveying graduates last spring for post-graduation employment information. The key areas of professional opportunity for students graduating from this program is in engineering roles in a variety of sectors which includes

structural, geotechnical, environmental, transportation, construction and water resources engineering. Additional careers in urban and community planning and civil site design.

Defining program constituencies and contacting these constituencies for feedback on the program education objectives is required for the ABET assessment process. One of the program constituencies for the CE program are the students who are included in the assessment process of the program.

Graduates from this program are highly successfully in obtaining post graduate employment. The demand for civil engineers is very high. According to the US Department of Labor Bureau of Labor Statistics, "Employment of civil engineers is projected to grow 11 percent from 2016 to 2026, faster than the average for all occupations."

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ABET assessment plan, the program has a Civil Engineering Industrial Advisory Board composed of constituents of the program. The program constituents are alumni, employers of graduates, and faculty. The board usually meets bi-annually to provide feedback on the program activities and student success.

The Civil Engineering Industrial Advisory Board was consulted prior to purchasing new surveying equipment and software. They advised to purchase the equipment and software from a new vendor because the professionals on the advisory board and in the local industry use equipment from the recommended vendor. This allows our graduates to be more familiar with the equipment they would be using if they chose to work in the local industry.

In addition to providing feedback for the program, the board has assisted the American Society of Civil Engineers student chapter reach a broader range of engineering professionals to be guest speakers at chapter events and have provided opportunities for student involvement in the local community. This support has helped the program connect the classroom to industry and lead to job opportunities for new graduates.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Nationally, engineering programs see substantial attrition in the first few semesters. According to one source, "A gulp-worthy 60% of freshmen engineering students eventually drop-out or change majors. Over 40% don't even make it through year one. The primary reason why students drop out of engineering programs is a lack of preparedness for the high level of rigor."

However as seen from the data above, the CE program at WKU has retention and student success averages above the university and national averages. The faculty believe this is attributed to the project-based nature of the program and the interaction of faculty and students.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3	12
Number of NTE Faculty					1	4
Cost per SCH					$138	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to foundation accounts generated from philanthropic giving. Two faculty members in the program hold endowed professor positions with an average endowment of $40,000 over the past five years. A faculty member in the program holds an endowed chair position with an average endowment of $39,000 over the past five years. These endowed positions support faculty scholarship and student project engagement. There is a large civil engineering industrial base in the region that could be used for further philanthropic giving.

The foundation money available to the program is not intended to support the daily needs of the program. A program fee and course fees sustain the program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The cost per student credit hour for the program is higher than the university average however this phenomenon is true across the United States. The WKU CE program produces a high number of graduates and student credit hours while delivering a project-based engineering program.

The American Society of Engineering Education studies the productivity of engineering programs across the United States. During the previous academic year, the WKU CE program had a BS degree recipient to faculty ratio of 10:1 which corresponds to the fourth highest ratio nationwide.

The student to faculty ratio is 50:1.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the CE program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, CE students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded including a required capstone design course sequence. Also, the culture of the program is such that most students participate in internships facilitated by the industrial liaison.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves industry and community problems in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8: Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 7.2: Increase 2-year to 4-year transfer by providing more degree pathways, completer (2+2) programs, and transfer advising. *A memorandum of understanding has been signed with SKYCTC so that students who complete a 2-year degree in pre-engineering can earn a civil engineering in 2 additional years.*
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *CE students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Careers available for civil engineering graduates include, but are not limited to, civil engineer, geotechnical engineer, environmental engineer, structural engineer, urban and regional planner, transportation engineer, and water resources engineer. According to the Kentucky Future Skills Report, the civil engineering and related fields have an estimated growth of approximately 17 percent across the state and approximately 24 percent growth in south central Kentucky in the next 5 years.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

Of the three CE programs in the state (UK, UofL, and WKU), the WKU CE program is unique in that it provides an undergraduate-only project-based curriculum across all four years. In support of this learning environment, the professional engineering activities of the faculty create opportunities for the students to practice the art and science of contemporary civil engineering, in and out of the classroom. Our graduates have a strong competitive advantage with their unique background of engineering fundamentals combined with practical knowledge and experience.

The program welcomes all students to the program, working closely with regional campuses and KCTCS to provide a pipeline to the CE major. Over the last 5 years, international students have added to the diversity of the student body. In addition, a new agreement with SKYCTC for a 2+2 CE program will widen the range of students entering the program.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

All engineering faculty at WKU are required to obtain and maintain a Professional Engineering license in Kentucky before tenure and first promotion, with anecdotal evidence that WKU is the only institution in the US with this requirement. The faculty believe this fosters a sense of preparation for professional practice in the students, helping them to be "*work-ready and fully prepared to pursue meaningful careers and lives*." The project-based philosophy of the program is unique in the state. WKU is increasingly an institution of choice for the study of civil engineering.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The program is well positioned to provide a traditional BS CE degree, with an emphasis on professional project-based learning experiences throughout the curriculum. Interdisciplinary connections exist through the reorganization of the program within School of Engineering and Applied Sciences. Since 2010 the number of CE students has increased from about 130 to approximately 200 students and represents nearly 30% of all of the engineering majors at WKU. The number of students entering the program (taking CE 176) each year averaged about 30 students per year a decade ago, and now averages nearly 60. Additionally, the increase in enrollment from 2013 to 2017 of the Construction Management (78 to 148) and Architectural Science (125 to 134) programs have put a strain on the CE program faculty who offer CE 160/161, CE 303 and CE 316 as part of the aforementioned programs curriculum. To move forward the staffing of the CE program needs to be addressed to handle the significant enrollment increases throughout the CE, CM, and AS programs.

The program sees opportunities for collaboration with other WKU disciplines such as world language and entrepreneurship to create concentrations or tracks within the program.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Nationally, the number of graduates with bachelor's degree from civil engineering programs decreased by nearly 3.5% from 2013 to 2017 and enrollment decreased of nearly 2.5%. During this time, the WKU CE program increased by 3.5%. The CE program is producing graduates at an increasing rate that exceeds the national rate, and at a quality level that is valued by local and national companies.

WKU CE graduates are successful in finding engineering jobs with starting salaries comparable to national average of $59,000 either upon graduation, or soon after.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

One of the main changes was offering senior design course as a common course for three engineering programs. It also might be valuable to take the same approach in other courses with similar nature for further commonality and consistency among the engineering programs.

Additionally, the CE program worked with both the construction management and architectural sciences program to eliminate a laboratory requirement which put a large strain on the faculty/staff due to staffing. During the fall 2017 semester, the program had one faculty member resign from the program and one faculty member retire. The program was only allowed to replace one of these faculty members.

At the same time changes to the requirements for transition from pre-major to major were initiated and coordinated amongst the 3 engineering programs. This can improve efficiency in faculty time and produce some commonality across three programs. The other change is the ongoing efforts for making more coordinated ABET activities between three engineering programs.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

In the next 5 years, employment of CEs are projected to grow 17% across the state and 24% in South Central Kentucky. Therefore, it is reasonable to assume the CE program will continue to grow as the need for more CEs continue to grow. Therefore, in five years, we hope that the program will see substantial growth in enrollment, retention, and conferral of degrees that exceeds our current growth.

In ten years, we would hope to maintain the continued growth of enrollment, retention, and conferral of degreese with additional resources. To make the CE program more attractive to prospective students, we should add additional courses to introduce students to additional topics that are only briefly discussed or not currently covered in the current curriculum.

With the current very limited resources, it will not be possible for the School of Engineering and Applied Sciences to accommodate the likely growth in the CE program. Considering the increased enrollment and loss of faculty line, the program would need more lab space and more faculty members to support any growth in the future. The program cannot continue to grow without additional resources.

Maintaining the culture of project-based learning and the link to the industrial world we serve must remain a priority.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	CNSS 4011
Reference Number:	1719
CIP Code:	111003
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences (SEAS)
College:	Ogden

Program Name:	Computer Information Technology
Reference Number:	555
CIP Code:	110103
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120
List Concentrations (if any):	None

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Computer Information Technology (CIT) program at WKU can help prepare students for many rewarding careers, including:

- Computer Network Architect
- Computer Programmer
- Computer Support Specialist
- Database Administrator
- Information Security Analyst
- Network and Computer Systems Administrator
- Software Developer
- Web Developer

The online program requires 120 credit hours and leads to a Bachelor of Science degree. No minor or second major is required.

Enrollment in the CIT program is limited and based on student qualifications. The program requires 36/60 hours of upper-division CIT coursework with a grade of "C" or better.

In order to be considered a 2+2 student and take advantage of the reduced number of hours (36 instead of 60), students must transfer to WKU with an A.A.S. degree (or equivalent) in a technology subject area from a regionally accredited school.

When initially created, the program was housed in the University College with courses were taught by Computer Information Systems (CIS) Department faculty from the College of Business. In Fall 2014, the program was moved to the Architectural and Manufacturing Sciences (AMS) department in Ogden College of Science and Engineering, which is now part of the School of Engineering and Applied Sciences (SEAS).

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	256	174	219	276	273	89
Conferrals	52	44	43	37	37	22
SCHP	2846	1877	2807	3347	3655	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The CIT program has a Joint Undergraduate and Master of Science Program (JUMP) with Engineering Technology Management (ETM). The faculty in the CIT program also support the graduate ETM program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The program is currently taught by two full-time tenured/track faculty and seven online adjuncts. Thus the SCHP cost is very low and the program is highly productive and efficient.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	16	68.8	19	36.8	19	42.1	17	70.6	22	27.3	69.4%
Progression	NA	NA	92	39.1	107	44.9	146	52.1	165	43.6	61.3%
150% Graduation Rate	9	33.3	17	11.8	15	20.0	10	70.0	16	31.1	54.1%
Time to Degree	3.84 (N=50)		3.48 (N=42)		4.28 (N=40)		3.58 (N=37)		4.47 (N=37)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The CIT program emphasizes and measures the skills, knowledge, and attitudes (SKAs) that information technology employers want (as reported by industry surveys).

The technology (hard skill) areas include aspects of:

- Databases
- Networking
- Computer hardware
- Security
- Technology management
- Programming

Soft skills covered include:

- Communications
- Analysis and problem-solving
- Flexibility and adaptability
- Interpersonal and team interaction
- Organization and planning
- Positive attitudes

These SKAs are assessed using pre-program surveys in the CIT introductory course, CIT 300. Students are assessed again in the CIT capstone course, AMS 490 (Senior Research), by using post-program surveys. As student identification data is collected in both courses, a pairwise comparison can be made for each CIT student.

At this time, there are only two complete semesters of AMS 490 data (N= 15). As a result, the only program improvement issue identified thus far is the need for more written communication projects due to an obvious lack of writing ability demonstrated by many CIT majors.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

All CIT graduates are surveyed annually regarding employment and/or graduate school interests; however, the response rate is less than desirable. In the AMS 490 exit survey, students are asked "Do you feel that the CIT program helped or will help you get a good job, promotion, and/or increased income?" The responses so far (N=15) are 80% yes and 20% maybe.

Demand and compensation for CIT graduates continues to excel. For a specific example, according to the U.S. Bureau of Labor Statistics (BLS), the projected percent change in employment from 2016 to 2026 for information security analysts is expected

to be 28%, while the average growth rate for all occupations is 7%. In addition, the average salary for information security analysts is $95,510 per year.

In terms of overall salaries for CIT graduates, the BLS also reports that the 2016 median salaries for computer information technology jobs ranged from $52,160 to $102,280 per year while the median family income for the same period was $59,039.

Also, recent CIT graduates report satisfaction with the program. See Section 3e.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The industry advisory board meetings are held annually. In these meetings, board feedback suggested the emphasis of cybersecurity. This recommendation sparked the idea of enhancing the CIT/MSETM JUMP with graduate cybersecurity courses to provide a more desirable graduate path for CIT majors. Another consideration was to create an online master's program dedicated to cybersecurity. A CPE first-level proposal was developed and was approved. This effort is still in process.

Also, because many KCTCS faculty teach adjunct for the CIT program, they report their experiences with employer needs and satisfaction.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Recent CIT graduates report satisfaction with the program:

Q. Do you feel that the CIT program helped or will help you get a good job, promotion, and/or increased income?

80% yes, 20% maybe

Q. Do you feel the CIT program helped you gain the knowledge, skills, and attitude that information technology employers want?

80% yes, 20% maybe

Typical testimonial:

"The CIT program was a great option for me because i already had an A.A.S in CIS and they took the credit, allowing me to complete a 4 year degree much faster, in my own time, completely on line."

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					2	12
Number of NTE Faculty					0	4
Cost per SCH					$95	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Due to the 100% online nature of this program, significant DELO revenue is generated.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Due to the large SCHP generated by full time faculty and the number of part time faculty used to deliver the program, the formula provided for cost per SCH did not give an accurate reflection of the cost of the program and thus was not used for table above. The estimate above was generated by considering impact of the adjuncts and on-demand courses.

The student to faculty ratio for the CIT program is 136:1.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The mission of Western Kentucky University (WKU) is to "prepare students of *all backgrounds* to be *productive*, engaged, and socially responsible citizen-leaders of a *global society*. The University provides *research*, service and lifelong learning opportunities for its students, faculty, and other constituents. WKU enriches the quality of life for those within its reach."

The CIT program contributes to this mission in that:

- It provides technical education to traditional students, but also reaches out to non-traditional students through its 2+2 program, resulting in a student population with very *diverse backgrounds*;
- It enhances *student productiveness* by teaching complex technology skills that are highly marketable;
- It addresses the *global initiative* by offering all courses online, which makes it available to anyone with an Internet connection;

And, the program teaches students to do *research* in computer information technology.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Policy Objective 4 identifies the need to support new pathways for adult learners to enroll and complete postsecondary degrees and credentials. The CIT program's online 2+2 initiative actively recruits KCTCS and other students with associate of applied science degrees, providing program credit for existing lower-level technology course hours. This effort results in approximately 75% of CIT majors taking advantage of the 2+2 pathway (Policy Objective 7.2).

This initiative also increases student diversity (Policy Objective 1), reduces the overall student cost of a bachelor's degree, and advances the STEM agenda (Policy Objective 9.6).

In addition, the CIT program works with local business and industry in terms of placing students in temporary and permanent jobs.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Occupational Outlook to 2024 states that Computer and Mathematical Occupation openings will increase 21.7% from 2014 to 2024.

The CIT program has long recognized that employment is of paramount importance to the state *and* to CIT students.

The program knows that CIT students want a good job, promotion, and/or increased income; that enhanced student employability helps students achieve a good job, promotion, or increased income; that students can increase their employability by giving employers what they want; and, as reported by industry, IT employers generally want employees with good technical skills including:

- Database skills
- Network skills
- Hardware skills
- Security skills
- Technology management skills
- Programming skills

IT employers also want good soft skills including:

- Communication skills
- Analytical and problem-solving skills
- Flexibility and adaptability
- Interpersonal and team skills
- Organizational and planning skills
- Positive attitudes

Thus, this is the mission of the program, what it teaches (see Section 3b), and how it directly addresses the state's workforce needs.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

This program is unique for several reasons:

- Transfer (2+2) students can complete the degree online with just 36 hours of CIT courses. CIT students can also complete the online JUMP MSETM degree in just 21 more hours.

- The program actively recruits IT students with AAS degrees, providing program credit for existing lower-level technology course hours. This can significantly reduce the overall student cost of a bachelor's degree.

- Not only can the degree be completed in a time and cost-effective manner, but it also is offered completely online. And, several classes are offered On Demand for increased schedule flexibility.

- In terms of technical skills, the CIT degree is track free. It covers fundamental and advanced technologies in an elective format, allowing students to choose the courses that most interest them.

Northern Kentucky University also offers a B.S. in CIT. The major difference between the programs is that WKU's CIT is completely online, attracts students from across the state and beyond, and provides a lower cost path for KCTCS and other students with AAS degrees. The NKU program is residential, primarily in the Cincinnati job market, while the WKU CIT program enrolls students from across the nation, which increases growth potential.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

This program supports workforce development particularly as society increasingly relies on smart systems and sophisticated manufacturing control systems. The need for graduates who understand the issues related to these areas and can generate solutions will only continue to increase.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

There are three major opportunities for the CIT program: outreach, face-to-face classes, and a cybersecurity emphasis:

1. Over the last three years, the program has experienced an approximate 76% growth in enrollments. This is primarily attributed to better management of student expectations, and providing more course options (like On Demand). However, it should be noted that this growth was accomplished without any recruiting. The program is distinctive because of the exceptional arrangement for 2+2 transfer students, but there are many students that don't know about the program due to lack of outreach. Thus, a significant growth opportunity could be realized if we had more recruiting resources.

2. As the program was designed for online adult transfer students, young on-campus CIT majors frequently struggle. Adding faculty for face-to-face classes would allow the program to better serve on-campus freshmen, and likely improve our first-year retention rate.

3. An advisory board recommendation was to better support cybersecurity in the curriculum. While we already have a JUMP with the MSETM, the MSETM classes are not aligned well with CIT. Thus, adding graduate cybersecurity courses to the MSETM, or creating a new cybersecurity master's program would make CIT even more attractive to potential/existing majors.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to National Center for Education Statistics, there were 39,593 nationwide enrollments in Computer and Information Sciences in 2009-2010. In 2015-2016, this increased nearly 63% to 64,405 enrollments.

In year 2009-2010, there were 887 CIT enrollments. In the year 2015-2016, this increased by nearly 9.6% to 972 enrollments.

The difference between CIT enrollment growth (9.6%) and national enrollment growth (63%) was likely due to movement of the program between colleges (see Section 1a).

If the same comparison is made with 2017-2018 CIT numbers (1160 enrollments), the increase is about 31%, which is closer to national averages, ignoring the yet unreported national enrollments for 2017-2018.

Kentucky trends may be more meaningful. The change in 4-year public enrollment in Computer and Information Sciences and Support Services from 2014-2015 until 2017-2018 was 2480 to 2838, respectively, or 14%. In the same time frame, CIT enrollments changed from 658 to 1160, respectively, or 76%. In other words, recently, WKU CIT is doing much better with enrollments than the state collectively.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The program offers 22 elective courses. This is very attractive to CIT majors because they come from diverse backgrounds, and appreciate the variety. A problem occurs with staffing so many classes with limited faculty resources. Due to student complaints about lack of elective offerings, On Demand elective classes were implemented a couple of years ago. The result has been very positive; we now cover about 30% of our enrollments using On Demand. And, even better, DELO reports that CIT students have the best completion rate of all On Demand students.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Cybersecurity

- Opportunity: We see the WKU CIT program taking a leadership role in the area of cybersecurity, which will give CIT students/graduates, and potentially others, more access to cybersecurity education (as described in Section 3d).
- What is needed?: Administrative and curricular support, graduate faculty staffing (in load or out-of-load)
- Impediments: Uncertain University environment

Face-to-Face CIT

- Opportunity: We also see a new emphasis in CIT face-to-face education to better support younger on-campus students (as described in Section 6a).
- What is needed?: Curricular changes, one full-time instructor
- Impediments: Uncertain University environment, lack of staffing

CIT Recruiting Emphasis

- Opportunity: We see quick growth by establishing a formal CIT recruiting program
- What is needed?: Recruitment staff to contact AAS programs in the region and across the country
- Impediments: Expensive, uncertain returns

SEAS Collaboration

- Opportunity: We see more CIT collaboration with other SEAS programs such as Computer Science and Technology Management
- What is needed?: Time to explore the opportunities
- Impediments: Commitments to other projects

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Computer Science
Reference Number:	117
CIP Code:	110101
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	33
List Concentrations (if any):	Net Centric

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The computer science master of science program is a graduate degree with areas of emphasis related to information systems, systems programming, computer networking, and algorithms. This program is delivered face-to-face and students can choose a thesis or non-thesis option. A JUMP program has been established with this degree to recruit undergraduate students to complete this degree. Graduates with this degree can work in the areas of software development, system analyst, and network or database administrator. Some graduates continued their graduate studies at PhD granting institutions.

A concentration “Net Centric” is provided to help students specialize in network computing.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	33	30	54	51	39	19
Conferrals	16	7	9	17	25	6
SCHP	453	456	1086	856	508	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the OSCE mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

The program also offers the core and supporting courses for the graduate certificate "Scientific Data Analytics, (0496)" as well as for "Computational Math" concentration for M.S. degree in Mathematics.

The graduate program also offers a JUMP pathway for the CS undergraduate students.

The graduate CS program also offers several classes to the Gatton Academy students and other programs as shown in the table below.

Course	Audience
CS 555	Foundation course for Scientific Data Analytics, (0496)"
CS 549	Core course for Computational Math(085)
CS 443G	Suggested elective for 0496 and 085

The CS program faculty teach a significant number of non-CS students in service classes as shown in the table below.

Academic Year	# Students	#SCHP
2014-2015	374	1262
2015-2016	325	1100
2016-2017	356	1302
2017-2018	409	1392
2018 (Fall)	293	1012

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The same faculty teach classes in both the CS graduate and undergraduate programs.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	12	91.7	11	72.7	7	57.1	9	88.7	6	100	82.2%
Progression	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
150% Graduation Rate	19	78.9	12	91.7	11	63.6	7	57.1	9	66.7	73.3%
Time to Degree	2.34		1.91		2.38		2.00		2.05		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

At the time of graduate, the students should have attained the following student learning outcomes (SLOs):

1. Demonstrate an in depth and comprehensive understanding of Computer Science.
2. Have an enhanced ability to learn, on their own, technical details for which they are responsible.
3. Have an enhanced ability to apply the knowledge learned to solve technical problems that arise in research they conduct or supervise.
4. Have an enhanced ability to study an issue, identify and evaluate alternative actions, propose an optimal course of action.
5. An ability to function effectively on teams to accomplish a common goal.

All graduate students have to either conduct research under the supervision of a thesis committee or pass the departmental comprehensive written exam.

The program regularly reviews the program for improvement. The assessment of the program includes feedback from faculty, alumni, and employers. As a result of assessment results, the format of the comprehensive exam(from four required courses to two core courses and one elective from a pool of three) was revised to reflect the strength of the core and allows the students to develop a more focused area.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The graduate program coordinator maintains a list of contacts of the recent graduates. Based on communication with students, all graduates are employed as soon as they graduate or pursue higher degrees. Based on our data, the graduates from the MS program have 100% job placement rate within three month of graduation. The key areas of professional opportunity for students graduating from this program are in a variety of sectors which includes IT support, database development, software development, cybersecurity applications, and research and developments.

According to Kentucky Statewide Occupational Employment Outlook, the demand for graduates that can work in computer occupations will increase 20.2% from 2014 to 2024. Graduates from this program are highly successfully in obtaining postgraduate employment. The demand for students with software development skills is very high and expected to increase 24% from 2016-2026

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The graduate program committee members attend the Industrial Advisory Board meeting and works with local industries to make sure that our curriculum is up to date and meets the needs of the employers. Based on the feedback, two new graduate level courses CS 535 (Cloud Computing) and CS 555 (Data Science) were proposed and were offered to keep the graduate curriculum technologically current.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					2.33	12
Number of NTE Faculty					0	4
Cost per SCH					$379	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	8
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	58.2%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Faculty in the CS programs have received $67,580 in the past five years to support research and student projects. The CS program has a foundation account from philanthropic giving which has averaged $72,000 over the past five years.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The computer science program full-time faculty nearly exclusively teaches all courses offered by the program. The percentage of student credit hours not taught by a full-time faculty member ranged between 4% - 8% during the last few years for undergraduate courses and 0% for graduate courses.

The cost per student credit hour for the CS program is higher than the university average which is true across the United States.

Due to the nature of the program, there is a need to maintain the computer laboratory facilities and create new facilities as the program grows. Modern equipment and software is a requirement.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

As discussed above, the graduates of the CS program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, CS students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices such as internships, study-abroad, service learning, and undergraduate research throughout their college career." Many of our students have on-campus job, providing IT and software development support. Also, the culture of the program is such that most students participate in internships facilitated by the industrial liaison.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The program directly supports the following aspect of the statewide strategic agenda:

- Objective 10: Increase basic, applied, and translational research to create new knowledge, accelerate innovation, and promote economic growth.
    - 10.5. Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Careers in computer science include software developer, computer programmer, web developer, app developer, computer hardware engineer, computer systems analyst, information security analyst, and project manager. Computer science graduates work in the sectors of advanced manufacturing and business and IT services which are fast growing areas according to the Kentucky Future Skills Report. 15% of the workforce in Kentucky is in these sectors.

U.S. Bureau of Statistics predicts 20 percent growth in Computer Science and related field from 2016 to 2026. The Kentucky Occupational Outlook to 2024 states that Computer and Mathematical Occupation openings will increase 21.7% from 2014 to 2024.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The CS program trains students to gain solid skill sets of implementation of software solution to support the sustaining growth of a companies and organizations. Alumni work at many local companies/organizations, such as Fruit of the Loom, Fiserv, in addition to WKU IT department. CS alumni also work in national-wide or international companies, such as IBM, Microsoft. CS students or alumni work not only in traditional IT areas, but also in inter-disciplinary areas, such as the geography information sciences and bioinformatics. The CS faculty is diversified in expertise.

In order to meet the needs of working CS professionals, the WKU MS program began offering evening graduate classes. This is the only Computer Science M.S. program that offers evening classes at the graduate level in south central Kentucky.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

Computing is at the heart of the job of someone who graduates with a computer science degree. Computer scientists solve challenging problems in areas such as science, engineering, finance, and health by designing the software to apply to generate a solution.

The rapidly growing sectors of South Central Kentucky are listed below with expected job numbers:

- Advanced manufacturing (25000+)
- Fabricated Metals (2000+)
- Food processing (5000+)
- Automotive (12000+)
- Plastic (3000+)
- Transportation and Logistic (4000+)

The fields listed above are partially supported by graduates from the computer science program.

In general, WKU computer science graduates are employed full-time immediately after graduation with salary ranges from $66,000 to $100,000.

Most computer science faculty members are active in research and scholarly activities. The graduate students have been an integral part of the research in the CS program.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

According the U.S. Bureau of Labor Statistics, there will be 1.4 million computing jobs available by 2020 while only 400,000 computer science students will graduate by that time. The IEEE Computer Society predicts that there will be in demand in the near future in the following areas, all of which are supported by computer science:

- Deep learning
- Robotics
- Assisted transportation
- Assisted reality and virtual reality
- Cybersecurity and Artificial Intelligence (AI)

South Central Kentucky is expecting to see growth in the automotive industry and manufacturing, which provides a bridge between the WKU computer science program and new technologies. Artificial intelligence has become an essential component of automated drive technology and it is important to know how it works in autonomous and connected vehicles. This reliance on AI indicates that data storage, retrieval, and analysis will be more important than ever.

The program offers the foundation courses for a graduate certificate "Scientific Data Analytics, (0496)".

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The Computing Research Association (CRA) conducts annual survey with universities that offer degrees in Computer Science across the US. Based on the recent CRA report, CS MS degree production in U.S. CS departments rose over 19 percent in 2016-17. This increase in degree production follows approximately 17 and 25 percent increases in the previous two years. Both public and private departments again reported large increases.

The CS graduate program enrollment decreased slightly in the last few years, mainly due to the increase of the international student tuition. The enrollment is now stabilized to about 20 students. The diversity of the students increased, as well as the ratio of female students in our program.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

To address the increasing needs of data science and cloud computing, two new courses CS 535 Cloud Computing and CS 555 Data Science were proposed and offered.

The program started to move the courses to the evening hours to accommodate the growing needs for computer science education from the local industries.

K-12 education has increased the offering of computer science classes to high school students. In response to this growth and recruitment opportunity, the program has taken steps to create a graduate certificate for K12 teachers to increase the number of computer science teachers in middle/high schools. This will not only increase the graduate enrollment, but also help increase the college readiness for STEM majors.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The M.S program has about forty quality graduate students. We will work in four areas to continue strengthen our program:

1. Continue to modernize our curriculum and expand our offering in mobile, cloud computing and data science.
2. Strengthen the collaboration with local industries to increase the enrollment from the local industries.

3. Work with other program in SEAS to increase the JUMP enrollment from EE and other programs.
4. Work with the international student recruitment to increase the international enrollment.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Computer Science
Reference Number:	341
CIP Code:	
Degree Type (AB, BS, etc.):	Minor
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	20
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The computer science minor focuses on problem solving using high-level programming languages. Students who are minoring in computer science can enhance their ability to solve problem in their field.

All CS courses counting toward the CS program minor must be completed with a grade of "C" or better. Students must complete the following requirements to earn the CS minor:
1. Completion of the following two required courses (8 hours): CS 180 and CS 221.
2. Completion of one of the following courses: CS 339 or CS 351.
3. Completion of 9 additional hours of CS courses at the 300-level or higher

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	19	13	9	20	29	26
Conferrals	3	0	0	0	3	6
SCHP	53	78	77	105	145	187

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

All courses required for the minor are embedded in the courses delivered to the major. The computer science program faculties provide all the courses required for the minor.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											NA
Progression											NA
150% Graduation Rate											NA
Time to Degree	11.56								6.22		4.20

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The WKU computer science programs, systems/scientific concentration has applied for accredited by the ComputingAccreditation Commission of ABET (www.abet.org). However, ABET does not accredit minors. The computer science minor is closely aligned with major and thus will share the following student learning outcomes (SLOs).

The program faculty developed the following student learning outcomes (SLOs):

At the time of graduate, the students should have attained the following:

(a): An ability to apply knowledge of computing and mathematics appropriate to WKU's computer science program.
(b): An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
(c): An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
(d): An ability to function effectively on teams to accomplish a common goal.
(e): An understanding of professional, ethical, legal, security and social issues and responsibilities.
(f): An ability to communicate effectively with a range of audience.
(g): An ability to analyze the local and global impact of computing on individuals, organizations, and society.
(h): Recognition of the need for and an ability to engage in continuing professional development.
(i): An ability to use current techniques, skills, and tools necessary for computing practice.
(j): An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
(k): An ability to apply design and development principles in the construction of software systems of varying complexity.

The program uses a variety of rubrics to assess these SLO's in support of the ABET assessment plan. The program then uses the results from this assessment to create an action plan to improve the program.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

According to Kentucky Statewide Occupational Employment Outlook, the demand for graduates that can work in computer occupations will increase 20.2% from 2014 to 2024. Graduates from this program are highly successfully in obtaining postgraduate employment. The demand for students with software development skills is very high and expected to increase 24% from 2016-2026.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)
As part of the ABET assessment plan, the program has an Industrial Advisory Board composed of constituents of the program which include alumni, employers of graduates, and faculty. The board meets to provide feedback on the program activities and student success.
e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					NA*	12
Number of NTE Faculty					NA*	4
Cost per SCH					$66*	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Faculty in the CS programs have received $67,580 in the past five years to support research and student projects. The CS program has a foundation account from philanthropic giving which has averaged $72,000 over the past five years.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

*Since all the courses required by the minor are embedded in the computer science major program, there are no faculty dedicated to the minor. The cost per SCH was determined by average the cost per SCH for the major and then multiplying by the ratio of hours in the minor compared to major.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Same as Computer Science program The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the students who earn a minor in CS are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the applied nature of the program, CS students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research.
  Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Careers in computer science include software developer, computer programmer, web developer, app developer, computer hardware engineer, computer systems analyst, information security analyst, and project manager. Computer science graduates work in the sectors of advanced manufacturing and business and IT services which are fast growing areas according to the Kentucky Future Skills Report. 15% of the workforce in Kentucky is in these sectors.

U.S. Bureau of Statistics predicts 20 percent growth in Computer Science and related field from 2016 to 2026. The Kentucky Occupational Outlook to 2024 states that Computer and Mathematical Occupation openings will increase 21.7% from 2014 to 2024.

A minor in computer science can help students who wish to be high school teachers since the number of high school computer science programs is growing and there is a need for credentialed teachers. Also a minor in computer science could make a student who is seeking employment in industry more marketable.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The CS program trains students to gain solid skill sets of implementation of software solution to support the sustaining growth of a companies and organizations.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

According the U.S. Bureau of Labor Statistics, there will be 1.4 million computing jobs available by 2020 while only 400,000 computer science students will graduate by that time. The IEEE Computer Society predicts that there will be in demand for CS graduates in the following areas:

- Deep learning
- Robotics
- Assisted transportation
- Assisted reality and virtual reality
- Cybersecurity and Artificial Intelligence (AI)

South Central Kentucky is expecting to see growth in the automotive industry and manufacturing, which provides a bridge between the WKU CS program and new technologies.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The Computing Research Association has provided information regarding the growth in CS majors since 2006. According to the site, "The average number of undergraduate CS majors is larger today than at any previous time, and greatly exceeds the peak enrollment of the dot-com boom period."

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The CS minor now gives students the option to choose between CS 339 (Computer Science III) or CS 351 (Database Management Systems). Students who are more business oriented can choose CS 351 option.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

This minor will continue to be a valuable option for students pursuing careers technology related careers.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Computer Science
Reference Number:	629
CIP Code:	110101
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120
List Concentrations (if any):	Any Minor, Specialty Option, Systems/Scientific Application

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The WKU Computer Science (CS) program focuses on the study of theoretical algorithms and the problems involved with implementing the solutions through computer hardware and software. Graduates with this degree can work in the areas of software development, system analyst, and network or database administrator. Some graduates pursue graduate degrees in MS/PhD granting institutions. Students in the Computer Science program are required to choose one of the following concentrations: systems/scientific applications (requires 30 hours of math and science), any minor option (requires minor), and specialty (requires 18 credit hours in a focus area).

The systems/scientific option of the CS program was recently reviewed for accreditation by the Computing Accreditation Commission of ABET, http://www.abet.org. The final results of this review will be known in July 2019, however the October 2018 visit was very positive.

Lower-level program courses have designated labs.

The computer science program requires the following courses from other departments in addition to the Colonnade requirements:

- MATH 136
- STAT 301
- COMM 145
- ENG 307.

To be admitted to the computer science major, students must complete CS 180, CS 221, and CS 339 with grades of "C" or better.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	194	207	222	196	193	89
Conferrals	13	18	21	19	26	22
SCHP	1373	1700	1623	1742	1733	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

This program also offers several classes to the Gatton Academy students and other programs as shown in the table below.

Course	Audience
CS 146	Colonnade course
CS 170	Meteorology, Mathematics, Psychological science, and Mathematical Economics
CS 180	Gatton Academy, Information System, Psychological science, Mathematical Economics, Mathematics, and Engineering
CS 221	Mathematics
CS 239	Electrical Engineering
CS 371	Gatton and Mathematics

The CS program faculty teach a significant number of non-CS students in service classes as shown in the table below.

Academic Year	# Students	#SCHP
2014-2015	374	1262
2015-2016	325	1100
2016-2017	356	1302
2017-2018	409	1392
2018 (Fall)	293	1012

The CS program also offers a JUMP pathway to the CS graduate degree that has been a successful recruiting tool for the graduate program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The program has many lab and project intensive courses that impacts the class sizes offered.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	28	75.0	45	68.9	50	78.0	68	63.2	45	57.8	69.4%
Progression	NA	NA	173	46.8	173	49.1	162	49.4	179	52.0	61.3%
150% Graduation Rate	33	39.4	29	41.4	32	37.5	35	31.4	28	46.4	54.1%
Time to Degree	4.49 (N=13)		4.82 (N=18)		4.43 (N=21)		5.62 (N=19)		4.16 (N=26)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The program faculty developed the following student learning outcomes (SLOs):

At the time of graduate, the students should have attained the following:

(a): An ability to apply knowledge of computing and mathematics appropriate to WKU's computer science program.
(b): An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
(c): An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
(d): An ability to function effectively on teams to accomplish a common goal.
(e): An understanding of professional, ethical, legal, security and social issues and responsibilities.
(f): An ability to communicate effectively with a range of audience.
(g): An ability to analyze the local and global impact of computing on individuals, organizations, and society.
(h): Recognition of the need for and an ability to engage in continuing professional development.
(i): An ability to use current techniques, skills, and tools necessary for computing practice.
(j): An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
(k): An ability to apply design and development principles in the construction of software systems of varying complexity.

The program uses a variety of rubrics to assess these SLO's in support of the ABET assessment plan. The program then uses the results from this assessment to create an action plan to improve the program.

For example, it was determined that the structure of the core programming classes was not adequate for student learning through the assessment process. Faculty are currently in discussion on revising the two core classes (CS 180 and CS 221) into three classes to allow sufficient time for students to develop a deep enough understanding of important concepts. It is anticipated that this restructuring will also improve student retention.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Based on communication with student during advising sessions (or other interactions), it seems virtually all graduates are employed as soon as they graduate or pursue higher degrees. The key areas of professional opportunity for students graduating from this program are in a variety of sectors which includes manufacturing, research and development, and cybersecurity applications.

According to Kentucky Statewide Occupational Employment Outlook, the demand for graduates that can work in computer occupations will increase 20.2% from 2014 to 2024. Graduates from this program are highly successfully in obtaining postgraduate employment. The demand for students with software development skills is very high and expected to increase 24% from 2016-2026.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, and national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ABET assessment plan, the program has an Industrial Advisory Board composed of constituents of the program which include alumni, employers of graduates, and faculty. The board meets to provide feedback on the program activities and student success.

The CS program coordinator received the following quote from Bethany Ross, Talent Acquisition of Principal SAIC:

> "I have recently spoken to some upcoming graduates from your Computer Science program and I've been very impressed with their skills. You guys are doing a wonderful job in preparing them for their careers."

At the advisory board meeting in Spring 2017, the board highlighted to importance of communication skills required of CS graduates. The program reviewed the current requirements and decided to assess the written and oral communication skills in separate rubrics to better gauge the student preparedness. The faculty implemented a requirement of written and oral communication into several required courses and then used the new rubrics to assess student skill.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

A significant number of students do not have computer science experience in high school but choose it as their major without understanding the field. Also, many students who enroll in computer science are not academically prepared to study this discipline.

One of the largest manufacturing company in our region, Fruit of the Loom (FOL), consistently hires CS graduates. As evidence of their support, FOL sponsors the 'best student' award among graduating students every year.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					6.17	12
Number of NTE Faculty					1	4
Cost per SCH					$197	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Faculty in the CS programs have received $67,580 in the past five years to support research and student projects. The CS program has a foundation account from philanthropic giving which has averaged $72,000 over the past five years.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The cost per student credit hour for the CS program is higher than the university average which is true across the United States.

Due to the nature of the program, there is a need to maintain the computer laboratory facilities and create new facilities as the program grows. Modern equipment and software is a requirement.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the CS program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the applied nature of the program, CS students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded including a required capstone design course.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research.
  Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Careers in computer science include software developer, computer programmer, web developer, app developer, computer hardware engineer, computer systems analyst, information security analyst, and project manager. Computer science graduates work in the sectors of advanced manufacturing and business and IT services which are fast growing areas according to the Kentucky Future Skills Report. 15% of the workforce in Kentucky is in these sectors.

U.S. Bureau of Statistics predicts 20 percent growth in Computer Science and related field from 2016 to 2026. The Kentucky Occupational Outlook to 2024 states that Computer and Mathematical Occupation openings will increase 21.7% from 2014 to 2024.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The systems/scientific option of the CS program was recently reviewed for accreditation by the Computing Accreditation Commission of ABET, http://www.abet.org. The final results of this review will be known in July 2019; however the October 2018 visit was very positive. WKU would be only the second non-Ph.D. granting university in Kentucky which offers a ABET-accredited computer science program.

WKU's Computer Science program offers two required project courses: one at the junior level and a senior-level cap-stone project course. This double-exposure is a good fit for our student population and as far as we know is unique in Kentucky. In these courses, students work on real-life problems with a team.

The CS program trains students to gain solid skill sets of implementation of software solution to support the sustaining growth of a companies and organizations. Alumni work at many local companies/organizations, such as Fruit of the Loom, Fiserv, in addition to WKU IT department. CS alumni also work in national-wide or international companies, such as IBM and Microsoft. CS students or alumni work not only in traditional IT areas, but also in inter-disciplinary areas, such as the geography information sciences and bioinformatics. The CS faculty is diversified in expertise.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

Computing is at the heart of the job of someone who graduates with a computer science degree. Computer scientists solve challenging problems in areas such as science, engineering, finance, and health by designing the software to apply to generate a solution.

The rapidly growing sectors of South Central Kentucky are listed below with expected job numbers:

- Advanced manufacturing (25000+)
- Fabricated Metals (2000+)
- Food processing (5000+)
- Automotive (12000+)
- Plastic (3000+)
- Transportation and Logistic (4000+)

The fields listed above are partially supported by graduates from the computer science program.

In general, WKU computer science graduates are employed full-time immediately after graduation with salary ranges from $66,000 to $100,000.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

According the U.S. Bureau of Labor Statistics, there will be 1.4 million computing jobs available by 2020 while only 400,000 computer science students will graduate by that time. The IEEE Computer Society predicts that there will be in demand for CS graduates in the following areas:

- Deep learning
- Robotics
- Assisted transportation
- Assisted reality and virtual reality
- Cybersecurity and Artificial Intelligence (AI)

South Central Kentucky is expecting to see growth in the automotive industry and manufacturing, which provides a bridge between the WKU CS program and new technologies.

One possible expansion is a software engineering program using the resources of the WKU Computer Science and Electrical Engineering programs.

K12 education has increased the offering of computer science classes to high school students. In response to this growth and recruitment opportunity, the program is in discussion with the College of Education to create a graduate certificate for K12 teachers to increase the number of computer science teachers in middle/high schools. This will not only increase the graduate enrollment, but also help increase the college readiness for STEM majors.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The Computing Research Association has provided information regarding the growth in CS majors since 2006. According to the site, "The average number of undergraduate CS majors is larger today than at any previous time, and greatly exceeds the peak enrollment of the dot-com boom period."

Based on last 5 years, the CS program has maintained steady enrollment but has not increased at rate of the national trend. A summary of enrollment data is in the table below.

	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
WKU CS Enrollment	194	207	222	196	193
WKU Enrollment	17,517	17,459	17,315	17,601	17,666
CS % of total WKU	1.1%	1.1%	1.2%	1.1%	1.0%

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

In order to attract more students and have an external validation of program quality, the program recently had an ABET accreditation visit in Fall 2018. Results of this visit will be official in July 2019 but it was a very positive visit. This visit was focused on the systems/scientific option.

As a result of the preparation of the ABET visit and the implementation of program assessment, the program is restructuring the core programming sequence (CS 180 and CS 221) to a three-semester course sequence. It is expected that this change will improve student retention in the program to allow for more time per topic to allow students to develop a better foundation. This work is currently in progress.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)	
A primary objective of the CS program is to increase its enrollment and graduation rate. More minors such as data science, cyber security, deep learning, and robotics would enhance our offerings and attract additional students. We would also like to explore cross-disciplinary possibilities with other disciplines to broaden our appeal as discussed previously. In the future, expansion of topics presented will certainly also be required by local businesses in south central Kentucky.	
e. What recommendation would you put forward for the program (check one)?	
☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Construction Management
Reference Number:	533
CIP Code:	151001
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The program in Construction Management (CM) is designed to provide students with technical and managerial skills needed to assume leading positions in the construction industry. Graduates obtain employment in a wide variety of organizations, including construction management firms, general contractors, and specialty contractors serving the commercial, industrial, heavy civil, and residential construction sectors. They may choose to become specialists in estimating, scheduling, safety, quality, or field supervision. Typical job titles include project manager, project engineer, office engineer, field engineer, estimator, quantity surveyor, and superintendent, along with many others. The teaching philosophy of this program focuses on project-based learning which is achieved by engaging students through hands-on class projects, and involving students in faculty consulting and applied research activities. Real projects often serve as class projects. This program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The program is offered face-to-face. No minor, second major, or certificate is required.

CM students take the following supporting courses outside of the major in addition to Colonnade courses:

- MATH 116
- CE 160/161 or AGMC 170/171
- CE 303
- CE 316
- AMS 163
- AMS 271
- AMS 271
- AMS 371
- AMS 430

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	78	96	114	144	148	89
Conferrals	8	25	19	19	31	22
SCHP	1022	1342	1430	2029	2115	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

The CM program offers required courses, AMS 261/262, to the architectural sciences program and elective courses to the civil engineering program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The construction management and architectural science program both support AMS 261/AMS 262 (Construction Methods and Materials), AMS 282 (Building Structures), AMS 305 (Building Codes), and AMS 325 (Survey of Building Systems(. These courses rotate among faculty in both programs.

The CM program is supported by two full time tenure track faculty members.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	8	62.5	9	55.6	14	50.0	19	78.9	17	58.8	69.4%
Progression	NA	NA	63	60.3	89	66.3	130	56.2	138	71.7	61.3%
150% Graduation Rate	6	33.3	13	23.1	8	50.0	5	40.0	7	57.1	54.1%
Time to Degree	4.92 (N=8)		4.68 (N=24)		4.98 (N=19)		5.06 (N=17)		3.90 (N=31)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of the assessment plan in support of ATMAE accreditation.

The student learning outcomes (SLOs) of the CM program are:

1. Graduates will be able to solve problems that involve analytical and numerical solutions.

2. Graduates will demonstrate the ability to solve problems that address economics such as evaluation of alternatives and life-cycle analysis.

3. Graduates will demonstrate the skills of construction management competencies including estimating, planning, scheduling, project control, safety management, and construction law.

4. Graduates will demonstrate the ability to conduct research and experiments, incorporating the collection, analysis and interpretation of data.

5. Graduates will have managerial and leadership experience through working in teams to solve problems, and participation in required internships.

6. Graduates will demonstrate their ability to prepare a real-world comprehensive construction management plan that integrates the use of standards and realistic contemporary constraints that may include control of health and safety issues, economics, and societal and global impacts.

7. Graduates will demonstrate an ability to communicate effectively using oral, written, graphic and visual applications.

8. Graduates will be exposed to the role and responsibilities of the construction management profession involving safety, green practices, ethics, and professionalism.

9. Graduates will demonstrate respect for diversity of peoples, ideas, and cultures; and awareness of their opportunities as responsible citizens living in a global society.

Part of the assessment process is the review of SLOs assessment with the industrial advisory board. The Industrial Advisory Board suggested that the students have more exposure to safety in their major. In response, the one credit hour course, AMS 140, was replaced with a three credit hour course, AMS 310, to increase the coverage of safety and ergonomics.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

As part of the ATMAE assessment process, graduates are surveyed each year regarding employment and/or progressing onto graduate/professional school. The key areas of professional opportunity for students graduating from this program are in the

building industry were graduates are employed as project engineer, estimator, scheduler, superintendent, project manager, and safety manager.

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According to Kentucky Statewide Occupational Employment Outlook, the demand for construction managers will increase 9.7% from 2014 to 2024.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ATMAE assessment process, employers are surveyed each year regarding satisfaction with our graduates. The program also has an active advisory board that meets regularly to give feedback to the program.

Through feedback from annual surveys, it was determined that a class in building codes would be more beneficial to the graduates than a course in soil mechanics. AMS 305 (Building Codes) was a course that was already offered. The program replaced CM 346 (Applied Soil Mechanics and Foundations) with AMS 305.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Graduates have 100% employment with an average starting salary of $55,000. They are hired in the local construction market, nationwide and internationally. Students perform well, grow in their career, and acquire leadership roles in the industry.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					2	12
Number of NTE Faculty					0	4
Cost per SCH					$78	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to a small foundation account that is shared by five programs. The average value over the past five years is $4,662.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. Course fees help sustain the program.

The student to faculty ratio in the CM program is approximately 60:1.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the CM program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, CM students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded including a required capstone design course.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges."

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research.
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Construction management graduates often gain entry-level positions as project engineers, estimators, supervisor, schedulers/planners, project coordinator, assistant facility manager, assistant project manager. Last year, Kentucky added 7.5% to its construction industry workforce . Kentucky faces a challenge to find qualified workforce to fill in the open construction jobs. The CM program graduates has a 100% placement within the industry. The CM program will continue to graduate students who are well qualified and ready to fill in construction positions in Kentucky.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The program is now home to an Associated General Contractors of America (AGC) charter chapter. The AGC is the leading association for the construction industry with 27,000 members nationwide. This allows CM students to participate in nationwide competitions. Also, it exposes our students to a huge number of construction companies for future employment all across the US.

The unique aspects of the program entails real life experiences in construction estimating, scheduling and project management. Graduates of the program are instantly prepared and ready to perform their job and demonstrate proficiency and leadership at the job place.

Eastern Kentucky University and Northern Kentucky University have programs in Construction Management.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)
The program provides students with a hands-on experience throughout the curriculum. Students gain hands on experience in construction methods by actually constructing a wood framed building. The estimating class provides a project-based experience in quantity take-off, pricing and submitting a complete turnkey job bid. The scheduling class allows student to comprehend the fundamentals of project planning and scheduling. Further, it put the knowledge gained form the theory into action through the use of scheduling software. Students utilize the software to prepare, control and manage the work schedule and cash flow of a real project

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

With a multibillion dollar budget for infrastructure work in Kentucky, the CM program can prepare students to be work ready in the infrastructure sector. To achieve this, the program can be redesigned to incorporate infrastructure construction classes. Pedagogy should focus on preparing students with the required technical and managerial skills that will allow them to acquire leading positions in that sector. The CM program shall work with the Civil Engineering (CE) program to develop such classes. Furthermore, the construction industry is using more visual reality technology. This new trend include 3D drawings, estimating, scheduling and facility management all under one umbrella called 6D Building Information Modeling (BIM). Since, the Architectural Science (AS) program already has 3D BIM classes, the CM program shall work with the AS program in developing 6D BIM classes that will prepare our graduates to become leaders and content expert in that field. The agility of the CM allows for interdisciplinary collaboration with the CE and AS programs that will have a positive impact on the program visibility, competitiveness and demand.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

For the past 3 years, the construction industry yearly spending growth has been 6%. The industry need for qualified construction managers has increased accordingly. The CM program at WKU has made it a priority to meet the ever-increasing demand.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

In 2017, the program hired two tenure track faculty. Prior to that time, there had been significant turn over in faculty positions.

Last year, the program finalized a four-year plan of study supported by the program information in the undergraduate catalog and ICAP. The plan serves as a guideline for students to monitor their progression in the program. The CM program made curriculum changes that allowed for an increase in the number of CM graduates without jeopardizing the quality of our graduates. Changes included adding the following classes to the program; Lean Principles, Quality Assurance, and Project Management. Furthermore, in 2014, the program dropped 9 credit hours from the major required courses. This change helped reduce the barriers to graduate students in 4 years and provided students with the knowledge they need to be successful in the construction industry.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

In five years, the program should offer classes that include design software/BIM, civil/infrastructure construction, heavy commercial construction, and sustainable construction.

In ten years, the program should incorporate important knowledge and experience in the business side of the industry such as marketing, financial accounting and HR. CM Students must acquire a minor in business.

To achieve the goals above, more personnel is required. Hires must have experience in BIM and civil/ infrastructure construction. Also, more computers and labs with the necessary software to perform quantity take offs, scheduling and project administration and control are needed.

Current impediments are hiring freeze; curriculum freeze; and budget and space constraints to provide new labs/computers.

e. What recommendation would you put forward for the program (check one)?	
☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE REASSESSMENT of ACADEMIC PROGRAMS
EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Data Analysis Using SAS, Certificate
Reference Number:	1716
CIP Code:	270599
Degree Type (AB, BS, etc.):	
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	15
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	0	0	1	1	1	4
Conferrals	0	0	0	0	1	5
SCHP	3	0	7	0	12	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											73.7
Progression			0	0	1	100	1	100	0	0	61.3
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden College of Science and Engineering

Program Name:	Earth Science
Reference Number:	#678
CIP Code:	40.0601
Degree Type (AB, BS, etc.):	AB
STEM+H Degree (Y/N)	N
Minimum Hours Required:	33
List Concentrations (if any):	none

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
This program is to be suspended.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Electrical Engineering
Reference Number:	537
CIP Code:	141001
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	124
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The mission of our Electrical Engineering (EE) Program at WKU is to build a foundation of knowledge in electrical engineering by integrating a variety of project experiences at every level throughout the curriculum. The electrical engineering curriculum exposes students to a variety of topics to prepare them for careers as engineers that includes circuits and electronics, control systems, power systems, and microprocessors to prepare student for jobs in the manufacturing sector and power industry. This program is accredited by the accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The program is offered face-to-face with some technical electives offered online from UofL. No minor, second major, or certificate is required.

EE students take the following supporting courses outside of the major in addition to Colonnade courses:

- MATH 136,137, 237, 331, 307
- STAT 301
- PHYS 255, 256, 265

Students are also required to choose elective courses that may be outside of the program.

Students are admitted as Pre-Majors in EE. To transition from Pre-Major to Major, a student must satisfy the requirements below. All courses below must have a grade of "C" or better.

- ENG 100
- Human Communications
- MATH 136
- MATH 137
- PHYS 255
- PHYS 256
- EE 210

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	174	148	132	156	156	89
Conferrals	24	13	22	15	26	22
SCHP	1488	1393	1483	1466	1527	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

This program offers a course EE 210 (Circuits I) that is required for mechanical engineering students. All faculty in the program also participate in the multi-disciplinary senior project course sequence by sponsoring teams of students to solve real-world problems. For the past three semesters and in the foreseeable future, an EE faculty member will be the course administrator for ENGR 490 which serves all engineering students.

Any student can enroll in the EE pre-major regardless of preparedness to be successful in the major. There is a significant number of students who declare EE as a pre-major that will change majors due to the math and science rigor required in the freshmen and sophomore year classes. The decrease in enrolled students and conferrals shown in the table reflects a national trend several years ago. However, the enrollment has recovered and stabilized while SCHP has increased.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Successful engineering graduates must be able to use the foundation in engineering problem solving to grow in the profession to meet the demands and challenges of the rapidly changing technological landscape. To meet this need, the EE program has a long history of offering engineering education where students can engage in a wide range of projects while learning the fundamentals of electrical engineering. In support of the project-based mission, the EE program has many lab and project intensive courses that impacts the class sizes offered.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	37	94.6	39	61.5	27	66.7	24	83.3	38	78.9	69.4%
Progression	NA	NA	128	54.7	104	56.7	112	55.4	115	53.0	61.3%
150% Graduation Rate	14	42.9	32	46.9	21	47.6	29	44.8	37	64.9	54.1%
Time to Degree	5.06 (N=22)		3.69 (N=12)		5.35 (N=21)		4.02 (N=15)		4.27 (N=26)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of the assessment plan in support of ABET (www.abet.org) accreditation.

The EE program faculty adopted the following ABET student learning outcomes (SLOs) to prepare graduates to enter the professional practice of engineering:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The program uses a variety of rubrics and other tools to assess these SLO's in support of the ABET assessment plan. The program then uses the results from this assessment to create an action plan to improve the program.

An example of using assessment results to improve the program was in improving the course EE 473. Rubric scores pertaining to the ability of students to apply knowledge of math and science were a bit low in that course. In response, the instructor decided to allocate additional lectures to review mathematics background material. Also, a grade of C or better requirement was added to one of the course's math prerequisites.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Electrical engineering students have multiple opportunities upon graduation. Most graduates are employed in the South-Central Kentucky region after graduation. Several students have also pursued graduate degrees after graduation.

To support graduate employment, a part time industrial liaison disseminates job and internship opportunities and assists students in development of professional skills such as resume writing and interviewing. Since the liaison began working at WKU in May 2017, she began surveying graduates last spring for post-graduation employment information. The key areas of

professional opportunity for students graduating from this program are in engineering roles in a variety of sectors which include manufacturing and research and development.

Defining program constituencies and contacting these constituencies for feedback on the program education objectives is required for the ABET assessment process. One of the program constituencies for the EE program are the students who are included in the assessment process of the program.

According to Kentucky Statewide Occupational Employment Outlook, the demand for electrical engineers will increase 9.8% from 2014 to 2024. Nationwide, the demand for electrical engineers will increase by 1.0% in the same time period with a median average salary of $93,010.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ABET assessment plan, the program has established the Electrical Engineering Industrial Advisory Board composed of industrial representatives across the region. The board usually meets annually to provide feedback on the program activities and student success.

The Engineering Industrial Partnership is a group of fifteen companies that pay an annual membership to support the engineering programs. The partnership meets formally twice a year to provide feedback on the success of the engineering students in their various companies.

As an example of the use of industry feedback, the faculty are currently considering an undergraduate certificate program in control systems which would be a joint effort between the Electrical Engineering and Mechanical Engineering programs. Industry representatives have indicated the need for graduates with this skillset.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Nationally, engineering programs see substantial attrition in the first few semesters. According to one source, "A gulp-worthy 60% of freshmen engineering students eventually drop-out or change majors. Over 40% don't even make it through year one. The primary reason why students drop out of engineering programs is a lack of preparedness for the high level of rigor."

For 2017-18, the EE program at WKU has first-year retention and 150% graduation rates above the university rates for 2017-18. The faculty believe this is attributed to the project-based nature of the program and the interaction of faculty and students.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3.6	12
Number of NTE Faculty					0	4
Cost per SCH					$195	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to foundation accounts generated from philanthropic giving. A faculty member in the program holds the Greulich endowed chair position with an average endowment of $16,000 over the past five years. This chair position is used to support the Center for Energy Systems.

Our engineering students in general, and our EE students in particular, have a unique learning opportunity to apply their class learning at the Center for Energy Systems housed in the School of Engineering and Applied Sciences. This experience will allow students to further develop professional skills such as effective communication, project management, experimental designs, team working, etc. in industrial projects supported by world class companies such as Samsung Electronics and Tempura Sealy International. Each academic semester, there are around 15 to 20 students and each summer around 10 students heavily engaged on industry-sponsored projects. The opportunity is unique as it is a meaningful research experience for undergraduate students.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. A program fee and course fees help sustain the program.

The cost per student credit hour for the EE program is higher than the university average which is true across the United States. However, the program produces a high number of graduates and student credit hours while delivering a project-based engineering program.

The student to faculty ratio in the EE program is 43:1.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the EE program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, EE students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded including a required capstone design course sequence. Also, the culture of the program is such that most students participate in internships facilitated by the industrial liaison.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves industry and community problems in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 7.2: Increase 2-year to 4-year transfer by providing more degree pathways, completer (2+2) programs, and transfer advising. *A memorandum of understanding has been signed with SKYCTC so that students who complete a 2 year degree in pre-engineering can earn an electrical engineering baccalaureate in 2.5 additional years.*
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *EE students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Electrical engineering graduates often gain positions as Design Engineers, Program Managers, Research and Development Leaders, control engineer, electronics engineers, electrical engineers, network engineers, within fields such as electronics, computer systems, power, manufacturing, biomedical, and robotics. 11% of people in Kentucky are employed in manufacturing industries which is a growth area according to the Kentucky Future Skills Report.

South Central Kentucky is a highly manufacturing-oriented region. According to 2018 Kentucky Directory of Manufacturers, there are 70 manufacturing companies in the city of Bowling Green, Kentucky. There are around 106 more manufacturers in the seven neighboring counties around Warren County. Recently, the demand has further increased in our region due to expansion of existing companies such as Logan Aluminum. Most of these manufacturers need and hire electrical engineers for their daily operations. According to government data, the average salary estimate for electrical engineers is $99,500 at the national level as of May 2017. With the trends of electrifications, renewable energies, smart cities/products, networking, mobile communications, etc. electrical engineering, as one of the STEM programs, remains very much in demand for close future.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

It is the mission of the WKU Electrical Engineering program to produce competent engineering practitioners. An engineering practitioner is one who has a foundation of basic science, mathematics, and engineering knowledge, combined with practical knowledge and experience in applying existing technology to contemporary problems. In addition to the contribution of technical talent to industries and communities in our region and beyond, the program adds value to the university and the community through the activities of its students and faculty. The distinctiveness of this program is the focus on project-based engineering education. Students in this program have multiple opportunities to engage in engineering projects throughout their educational career. The EE program produces graduates who can establish careers as engineers or pursuing graduate studies. The EE program serves the industrial employment needs of our primary service area as well as the entire commonwealth. The focus on undergraduate engineering education by the faculty is unique to most engineering programs in that the faculty are the classroom and laboratory instructors. Recently, a Memorandum of Understanding has been signed with SKYCTC to create an engineering pathway.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

All engineering faculty at WKU are required to obtain and maintain a Professional Engineering license in Kentucky before tenure and first promotion, with anecdotal evidence that WKU is the only institution in the US with this requirement. The faculty believe this fosters a sense of preparation for professional practice in the students, helping them to be "*work-ready and fully prepared to pursue meaningful careers and lives*." The project-based philosophy of the program is unique in the state. WKU is increasingly an institution of choice for the study of electrical engineering.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

Two potential opportunities are currently being considered:

(1) An undergraduate certificate program in Control Systems, a joint effort between the Electrical Engineering and Mechanical Engineering programs.

(2) An undergraduate minor in Software Engineering, a possible joint effort between the Electrical Engineering and Computer Science programs. Although this is in the beginning stages of a possible proposal, if implemented it will leverage the new relationship between these two programs as part of the School of Engineering and Applied Sciences.

The program sees opportunities for collaboration with other WKU disciplines such as world language and entrepreneurship to create concentrations or tracks within the program.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to the document "Engineering by the Numbers" by Dr. Brian Yoder, full time undergraduate enrollment in Electrical and Computer Engineering nationally increased from 91,336 in 2013 to 103,827 in 2017. During roughly this same period, WKU EE enrollment has declined from 174 in 2013-14 to 156 in 2017-18. It should be mentioned, however, that WKU EE enrollment increased from 132 in 2015-16 to 156 in 2016-17 and remained at 156 for 2017-18.

The Electrical Engineering program is accredited by ABET, which establishes specific criteria pertaining to curricular requirements. ABET states that "We currently accredit 4,005 programs at 793 colleges and universities in 32 countries". The WKU EE program has been ABET-accredited since 2005 and has been satisfying these criteria as a requirement for accreditation. Since these criteria are applicable to all ABET-accredited programs, ABET accreditation suggests some degree of curricular alignment between the WKU EE program and other programs similarly accredited.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

One area of concern in our curriculum is the availability of upper-division courses in sufficient number and variety to satisfy our students' interests. We are working with other programs at WKU such as Physics and Computer Science as well as with the University of Louisville to actually *increase* the choices of electives our students have, while still providing the core courses and the majority of the electives using our own faculty. An example of a WKU course that is soon to be accepted as an elective in our program is PHYS 445 Electromagnetism II. Another course, CS 360 Software Engineering is currently being considered. The courses offered to WKU students from the University of Louisville include topics different from our faculty's expertise, broadening our students' exposure to the field.

Maintaining the relationship with UofL is one way electrical engineering is making the best use of limited resources. Another area in which electrical engineering has participated in improving efficiency is in combining with the other WKU engineering programs in offering a harmonized, interdisciplinary senior project experience. This allows for a greater variety of projects and improved utility of the limited faculty resources available to this important element of our curriculum.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

In five years, we hope that the program will continue to see enrollment growth and that there will be at least one new faculty member and additional staff members (technicians and/or instructors) to support the labs and facilities required to do projects

effectively across all the engineering programs. In ten years, we would like more students with another faculty member. We would also like to develop, in partnership with the computer science faculty, new programs in computer engineering and/or software engineering. In order to support growth and new program development, we need additional faculty members and staff support. Currently the faculty are stretched to support the courses (lectures, labs, and projects) we currently offer to the number of students currently enrolled. Faculty and staff resources are the single greatest impediment to the continued development of WKU's electrical engineering program.

Maintaining the culture of project-based learning and the link to the industrial world we serve must remain a priority.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Engineering Technology Management
Reference Number:	0447
CIP Code:	151501
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	33
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Master of Science in Engineering Technology Management (MSETM) produces graduates who are equipped to manage organization resources, lead technological change, and strategically integrate higher level knowledge within their companies. This program provides a broad-based core of management competency in business functions, along with a solid understanding of engineering technologies and capabilities. Courses build upon existing technical competency while allowing the student to customize their depth of study in specific management technologies that enhance long-term professional career goals. Courses in this program are offered both face-to-face and online.

The current MSETM program was transformed from the former MS in Technology Management (#045).

A JUMP program has been established with this degree to recruit undergraduate students to complete this degree.

This program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	54	53	72	56	29	19
Conferrals	11	11	6	10	17	6
SCHP	606	572	816	536	261	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

The program has a JUMP option for undergraduate programs. The same faculty teach classes in both this program and the architectural sciences, construction management, manufacturing engineering technology and technology management programs.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	9	66.7	5	60.0	4	75.0	4	25.0	7	100.0	82.2%
Progression	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
150% Graduation Rate	8	28.6	9	44.4	5	20.0	4	25.0	4	25.0	73.3%
Time to Degree	2.52 (N=7)		2.61 (N=6)		6.33 (N=1)		3.92 (N=4)		3.38 (N=8)		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of the assessment plan in support of ATMAE accreditation.

The program faculty developed the following student learning outcomes (SLOs):

- Graduates will demonstrate the knowledge and capacity to apply managerial/ leadership principles and practices.
- Graduates will possess/ demonstrate the ability to identify, formulate, and solve technical problems.
- Graduates will demonstrate an ability to communicate effectively in pertinent areas, both written and oral.

The Certified Technology Manager (CTM) exam is used to assess our program outcomes. The CTM program is based on a broad-based multi-subject exam with a technology management emphasis. MSETM students' scores are above the national average in the technical competencies (systems, processes, operations, projects), but mixed on the managerial competencies (above in leadership, people, and quality, but below in self-management and risk). Note that students may not try as hard to pass the exam since it is not required and; thus, potentially skew the data.

An example of using the assessment process to improve the program is relates to assessing the defense oral presentation and the thesis topic abstract. Since spring 2016, students are required to submit a thesis topic abstract proposal at the beginning of their thesis hours and give a thesis oral defense at its completion. The abstracts and oral defenses are scored by graduate faculty who are not member of the thesis committee. On a Likert scale, the goal is for 80% of students to average a score of 4 or better for the oral defense and for 60% of students to average a score of 4 or better on the thesis abstract. This assessment is highly congruent with the primary program outcome of demonstrated excellence in oral and written communication

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

As part of the ATMAE assessment process, graduates are surveyed each year regarding employment and/or progressing onto graduate/professional school. Through the surveying process, the program obtained the following results in November 2017:

- Average starting salary of MSETM graduates: $86,923/year
- Average time to complete MSETM degree: 2.6 years
- Graduates who report advancing professionally and financially as result of degree: 80%

The key areas of professional opportunity for students graduating from this program are in four primary categories:

- Managers
- Engineers
- Entrepreneurs
- Educators

Job titles such as Project Manager, Project Engineer or Quality Manager, Quality Engineer, Facilities Engineer, Small Business Owner, Professor, Senior Technical Staff, Operations Managers, etc. The applied areas are wide ranging such as manufacturing,

construction, architecture, technical health services, information technology, telecommunications, government, food processing, technology development, vocational teaching, design, and administration.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ATMAE assessment process, employers are surveyed each year regarding satisfaction with our graduates. The program also has an active advisory board that meets regularly to give feedback to the program.

An example of improving the program based on industrial feedback is requiring the statistic course (AMS 580) for the program since quantitative skills are imperative for success in industry. Most companies need employees who can provide and analyze data. Also, it was determined by the faculty and the advisory board that the use of a national certification exam in the topical areas covered by the CTM exam were appropriate for program assessment, particularly since the revision of the CTM exam in 2015. Effective spring 2016, MSETM students who are enrolled in their first semester of thesis, are now required to take the exam and exam results are scored and compared with national averages.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.61	12
Number of NTE Faculty					0	4
Cost per SCH					$185	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	8
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	58.2%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to a small foundation account that is shared by five programs. The average value over the past five years is $4,662.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. However, there is little expense that is not related also to the undergraduate program.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

This program supports several aspects of the WKU Strategic Plan:

- Our Community and Beyond, Continuing Education: Engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges
- Our Community and Beyond, Continuing Education: Ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others.
- Our Community and Beyond, Continuing Education: Offer quality graduate programs to further lifelong learning and retraining.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The program directly supports the following aspect of the statewide strategic agenda:

- Objective 10: Increase basic, applied, and translational research to create new knowledge, accelerate innovation, and promote economic growth.
  - 10.4. Increase opportunities for undergraduate students to conduct or assist in research.
  - 10.5. Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Over 200 manufacturing firms in the South-Central Kentucky region employ over 31,600 workers with a total payroll of nearly $450 million. It is the largest employment sector in the region (30%) and represents a broad range of diverse industries. While the vast majority of manufacturers in South Central Kentucky are small, employing fewer than 250, almost all workers earn benefits and higher-than-average wages. The region is projected to need over 9,000 workers by 2020 to fill critical middle-skill production and maintenance jobs, as well as management and engineering positions, due to impeding retirements and new job growth. (An Urgent Call to Action in Support of Manufacturing South Central Kentucky/Barren River Region, June 2013).

Market demand research by the Education Advisory Board (2014) found over 2000 online job postings for bachelor's-level manufacturing employees in Kentucky. Twenty-four percent were in the Greater Louisville area.

MSETM graduates gain positions as managers, engineers, designers, and technical staff with engineering and manufacturing firms. Promotion opportunities include the positions of Chief Operating Officer, Plant Manager, and Engineering Manager in manufacturing-related and technical services organizations. 11% of people in Kentucky are employed in manufacturing industries which is a growth area according to the Kentucky Future Skills Report.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The field known as management of technology links engineering, science, and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish strategic and operational objectives of an organization (National Research Council, 1987). The purpose of the WKU MSETM program is to develop leaders with skills, knowledge, and vision to manage changing business needs for economic and community development that increases international competitiveness.

The MSETM program is different from MBA and engineering Master of Science degrees. Many students in the MSETM program who already have MBAs or Engineering MS degrees choose the MSETM program because this degree is applicable to their professional growth and salary.

The MSETM program was initially accredited by ATMAE in Fall 2013 and reaccredited in Fall 2018. This program is one of only four similar programs in the US to be accredited.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The WKU MSETM is one of the thirteen master-level program accredited by ATMEA in the United States and is listed in the top 25 best online master's in engineering management programs in the nation based on the quality of program and range of courses provided.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The Master of Science in Engineering Technology Management develops leaders to support the needs of the modern worldwide industry. The curriculum enhances both career and personal objectives. Graduates of the program are equipped to manage organization resources, lead technological change, and strategically integrate higher-level knowledge within their companies. The MSETM program provides a broad-based core of management competency in business functions, along with a solid understanding of engineering technologies and capabilities. Several opportunities for the program are listed below:

- After formation of the School of Engineering and Applied Sciences, the engineering undergraduate students have the opportunity to enroll in the program as JUMP students. With better recruitment and placement of majors from engineering program, the number of JUMP students can increase in the program.
- MSETM faculty and students collaborate and engage with WKU Engineering Industrial Partnership to the growth and development of the engineering talent in the region.
- The majority of the students of the program are the engineers working in industries who want to transition into management. These programs help engineers gain the staffing, operational and project management skills needed to supervise units and oversee companies. With a better recruitment in industries, there is a good potential to increase the enrollment.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The manufacturing sector's robust job situation is exacerbating the industry's pre-existing skills-gap challenge, which is rapidly evolving into a full-blown workforce crisis. The National Association of Manufacturers (NAM) Outlook Survey for 3rd Qtr. 2018 found that 73.2 percent of manufacturers stated an inability to attract and retain workers is their top concern. The survey also found nearly half of manufacturers (45.4 percent) cited this crisis as the number one threat facing their business. More than one in four (28.4 percent) said that it has forced them to turn down new business opportunities, and one-third (33.2 percent) noted that they have postponed plans to hire more workers due to workforce constraints.

The growth in this graduate program enrollment has not maintained the pace of national trends. This can be attributed to lack of faculty resources which limit the number of courses that can be offered and the recruitment effort.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The primary objective for graduates of this program is either career advancement or improvement of employment skills for the present job. As such, these students are interested in topics of currency that will benefit them immediately or in the short term. Right sizing the number of classes, tightening admission requirements, and focusing on the working professional student constituents has stabilized the program quality and prevented further program quality slippage. Courses that were offered face-to-face have been cut as international enrollments decline. Without continued opportunities for GAs, scholarship growth, and dedicated faculty, program quality may suffer.

Other significant changes include:

- The program discontinued the practice of admitting students with conditions. This was done to ensure all students entering program met minimum program admission requirements before taking any coursework. (Fall 2016)
- The program was reaccredited by ATAME. (Fall 2018)

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Five Years: With renewed marketing strategies and better recruitment from engineering undergraduate program, we expect increased enrollment in the program as JUMP students. Moreover, we expect increased enrollment in the program with collaboration and engagement with the WKU Engineering Industrial Partnership and local industries to the growth and development of the engineering talent in the region.

Ten Years: Enhance the program capabilities by offering areas of concentration. Each concentration is a collaborative effort between the MSETM and another program or working group of School of Engineering and Applied Sciences, such as Building System Group including Architectural Science, Construction Management, and Civil Engineering programs.

Impediments: Program enhancements cannot take place without full time dedicated faculty to teach the classes and conduct student thesis research. All MSETM courses are taught faculty who also teach undergraduate courses in other programs.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden

Program Name:	Environmental Studies and Sustainability
Reference Number:	479
CIP Code:	
Degree Type (AB, BS, etc.):	Minor
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	22
List Concentrations (if any):	None

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

- **This is a 22-hour Minor program that supports multiple majors across WKU**
- **Ten hours of core courses are required: GEOG 280, GEOG 380, GISC 216, which are General Education courses**
- **Twelve hours of advisor-approved electives may be selected from eight different disciplinary offerings, with at least two disciplines required. Twelve hours of coursework are required at the upper-division level.**
- **An ESS Minor provides a solid interdisciplinary environmental foundation for students pursuing majors in other science disciplines, in Social Science, Business, and Health.**
- **Students recently completing an ESS Minor have majored in Social Studies, History, Political Science, Economics, Biology, Recreation, Music, Sociology, and Engineering.**
- **As all major programs in the Department of Geography and Geology do not require a Minor program, most enrollment comes from outside the Department or as additional coursework in the Department beyond major requirements to support Meteorology, Geology, or Geographic Information Science.**

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	20	22	12	10	22	26
Conferrals	5	2	4	1	1	6
SCHP	132	176	93	77	150	187

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- Data above included enrollments and conferrals from programs that were rolled into this Minor.
- As all major programs in the Department of Geography and Geology do not require a Minor program, most enrollment in Minor programs comes from outside the Department or as additional coursework in the Department beyond major requirements to support Meteorology, Geology, or Geographic Information Science.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

- Likely to see increased enrollment as the three primary majors in the Department are transformed into one B.S. Geoscience major that will require a minor. Likely effective date is Fall 2020.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	N/A										
Progression	N/A										
150% Graduation Rate	N/A										
Time to Degree	3.89		4.00		3.45		3.67		3.67		4.20

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Intended Education Student Outcome #1
Students demonstrate engagement with the fundamental principles of research and writing in the geosciences and be able to articulate the principles of the scientific method.

Intended Education Student Outcome #2
Students can apply fundamental concepts, such as place, scale, region, and diffusion, that make up the "geographer's toolkit" for analyzing patterns of human and environmental activity around the world and identifying, mapping, and quantifiably assessing geospatial and environmental data.

Intended Education Student Outcome #3
Students can explain the complexities of social, cultural, and environmental diversity, and demonstrate critical thinking and evidence-based argument skills related to complex and nuanced real-world social, cultural, and environmental problems in a geographic context.

Means of Assessment for Outcome #1 Identified Above
All students must pass the research and writing intensive *GEOG 300 – Writing in the Geosciences* course, which requires students to produce a fully referenced research proposal.

Means of Assessment for Outcome #2 and #3 Identified Above
A comprehensive exam is given during the senior semester to all students completing the program. The exam consists of questions from the upper-division courses specific to each concentration. Additionally, all upper-level courses in the program require students to complete a comprehensive and discipline-specific essay or project that demonstrates applied skills.

Use of Results to Improve Instructional Program
Based on the above assessment strategies, we restructured the GEOG 300 course to include both written and verbal communication. Research and writing opportunities now are provided in each upper-level course to offer students more opportunity practicing research and writing in the discipline. Courses are more applied in nature so students have an opportunity to apply course content to solve real-world problems and conduct original research that directly benefits the WKU and broader south-central KY communities. Required preparatory courses have been restructured to incorporate current anthropogenic challenges.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Most alumni feedback comes from interpersonal communication with faculty. We remain in regular contact with our graduates and their employers and keep a database of information on both. There is no national exam for the B.S. Geography and Environmental Studies program.

Embedded in the exit exam of GEOG 499, our capstone course, is a survey that provides feedback on the nature of the program and career plans of students. An alumni survey is available on our website.

Approximately 25-30% of our students have applied for graduate school, with a 100% acceptance rate (with funding) in universities across the U.S.

U.S. News ranks geography at #7 in best science jobs, and the Bureau of Labor Statistics projects 11% job growth between 2016-2026 in environmental studies, which is faster than the national average. The skills and content learned through the degree program provide a lot of career flexibility, but students are overwhelmingly employed specifically within the geography and/or environmental studies fields. Students are employed in education, business, government, non-profit, and private sector consulting.

The *Twenty Fastest Growing Kentucky Occupations Generally Requiring a Bachelor's Degree* include two careers that program graduates are prepared for: Environmental Scientists/Specialists (change 38.24%) and Cartographers/Photogrammetrists (change 30.02%).

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Our faculty remain in constant communication with employers, public agencies in the region, and private corporations relevant to our students. This communication allows us to be responsive to market needs and builds relationships that help our students receive internships and gain employment. For example, locally, our faculty have ongoing meetings and projects with the City of Bowling Green, BGMU, EnSafe, and USDA, all of which have employed and/or offered internships to our students.

Feedback from graduates indicates that internships are one of the most valuable components of the program. **We have a 90% success rate with students being employed full-time with the organizations in which they completed an internship**.

Over the past 5 years, we have restructured program curriculum in response to feedback from employers and analysis of national trends in the field. For example, data suggested that students need more applied skills, better communication skills, and greater understanding of environmental regulations. As a result, each upper-division program course has an applied component, we developed seminar and field techniques courses to give students first-hand experience in the field, and we changed the environmental law, natural resource management, and environmental planning courses to better incorporate the information needed by today's employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The program has successfully placed students as employees/interns at multiple businesses and agencies, including Fruit of the Loom, BGMU, the City of Bowling Green, Oxford University (UK), USDA, WKU, University of Louisville, and Warren County Water District, to name a few. Local demand for student interns is beginning to exceed current supply, indicating potential for growth. The applied nature of our program allows students not only to contribute directly to geography and environmental studies problems, but also to build their portfolios for future employment. Because of their training, our students are successfully participating in study abroad, international research/internships, and conferences.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					5.25	12
Number of NTE Faculty					3.25	4
Cost per SCH					0.00	128.00
SCHP/FTF by Dept.	NO DATA				SEE #675	
% SCH by FTF by Dept.	NO DATA				SEE #675	
Median Class Size by Level	NO DATA				SEE #675	
% Under-Enrolled Sections by Level	NO DATA				SEE # 675	

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Over the past five years, more than $17 million dollars in grant and other revenue has been generated by the faculty and students of the Department. Due to the interdisciplinary nature of our programs, students from multiple programs, including the Geography and Environmental Studies program, have benefited from this revenue and have participated in the projects the funding supported.

Revenue from research centers affiliated with the Department, specifically Crawford Hydrology Laboratory and the Center for Human GeoEnvironmental Studies, as well as the Kentucky Geographic Alliance housed in the Department, is used not only to generate revenue for WKU, but also to support student research and training. These Centers employ or offer internships to an average of four undergraduate students, annually.

The Karst Field Studies program, part of the Geography and Environmental Studies curriculum, has brought over 3,100 students from 42 states and 17 countries since its inception, putting money into the local economy through housing, transportation, and food, and to WKU through tuition dollars paid.

Our programs have five endowed scholarships for students, with the majority of endowments coming directly from program alumni. Approximately 75% of our graduates donate at least $10 annually for the first five years post-graduation.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Because of the integrated nature of the programs in the department, it is difficult to separate data from the individual programs from data for the entire department. Faculty in the GISC/METR/GEOL programs also teach in GEOG. Many of our classes are capacity controlled (capped at 10-20 students) because of technology and lab capabilities, writing and reporting requirements, and the hands-on nature of the work. We team-teach Colonnade courses with other colleges, and generate significant Colonnade SCHs overall. IR data are distorted because we offer 1-3 hour internships and practicums (non face-to-face) that seem to be counted as regular courses.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Environmental understanding and proficiency is critical to students' preparation for "career and life in a global context." Modern society increasingly entails global connections. One need only consider climate change, security, health, and business. Environmental Studies provides tools for understanding interactions between places and across scales. According to a *New York Times* survey (5/16/2017), people's ability to locate correctly North Korea on a map correlated with favorable views of diplomatic and nonmilitary strategies for dealing with the potential nuclear threat from that country. It is not a stretch to conclude that environmental ignorance poses the greatest risk for mutually assured destruction. Of all the disciplines, Environmental Studies and Geography work together directly to nurture a global view and place international issues at the heart of the curriculum.

The program supports the objectives "Improve the quality of life regionally, and support regional economic diversification" and "prepare students for career and life in a global context." Many courses are taught via project-based learning and students often participate in collaborative projects that contribute to the well-being of local and regional communities. Students employ what they learn in courses for real-world geospatial and environmental problem-solving and decision-making, and experience first-hand the meaningful outcomes possible.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Objective 2, Strategy 2.2: Received funding from the National Geographic Society Education Foundation Grant, annually, to educate Kentucky teachers (both in-service and pre-service teachers) about geography and GIS.

Objective 2, Strategy 2.5: Offer both face-to-face and online courses. Implemented one dual credit course, with two other courses in development.

Objective 6, Strategies 6.1 and 6.2, and Objective 7: We have restructured the program, with plans to continue to do so, to better accommodate the "time to completion" of students transferring to WKU and changing majors. We work closely with

KCTCS advisors to ensure students are prepared for our degree program, with pipeline strategies in place. Through these efforts, we have decreased our majors' total number of credit hours earned from 140 to 126 hours on average.

Objectives 9 and 10: Contribute to the economic and social welfare goals of HB 1 by educating and training students to meet the needs of the employers in various geospatial and environmental studies industries, organizations, and government agencies via project-based learning. Graduates from this program are well-trained, highly regarded, and in high demand in the region and the Commonwealth. We provide up-to-date teaching and training of geospatial and environmental technologies to students.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Kentucky is seeing growth in job sectors that relate to several geography and environmental studies fields, which all align well with the skillsets with which our students are graduating. Collectively, because of its wide applicability and the diverse nature of the discipline, the Geography and Environmental Studies program directly addresses the workforce needs for the following general occupations:

- Construction project management, education & training, farming, forestry and natural resource management, petroleum/pipeline, healthcare support, state and local government, water technicians, life/physical/social science, census technicians, sustainability coordinators, consulting, urban planners, environmental scientists, and transportation.

There will be over 2,000 job openings requiring geoscience expertise in Kentucky through 2021, which offers a high probability of employment, as well as high demand for the program for those seeking these employment types.
Due to the highly interdisciplinary and applied training provided through the program, graduates are competitive across a wide range of positions that integrate well with growing sectors in the state. Nationally, there are nearly 200,000 jobs projected through 2021 for geoscientists, so the program is also filling a need beyond just the state through its training.

The average wage for jobs related to the program is nearly $7,000 over the state mean.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The program is distinctive in its design, delivery, reputation, and regional impact. The Geography and Environmental Studies program **is the largest undergraduate program of its kind in the Commonwealth** and **the only program in Kentucky that incorporates a comprehensive approach to traditional geography, applied GIS, and environmental studies.**

Its Karst Field Studies summer courses are the **only field-based, comprehensive karst-specific courses offered in the U.S**. **Aside from WKU, only the University of South Florida offers a degree concentration specific to cave and karst science**.

Through its interdisciplinary and applied research/internship/study abroad requirements, students conduct projects and research about a variety of interconnected and complex geospatial and environmental studies issues in settings across the globe. **Employers in Kentucky, Tennessee, and the surrounding region recognize the unique comprehensive and applied nature of our courses, as well as the overall quality of the program, and seek out its graduates.**

Two Kentucky state geographers are from the program.

We support regional campuses, dual credit courses at Glasgow campus, online and On Demand offerings.

The faculty represent Asian, European, and Native American experiences, while majors come from nine different countries, with fairly equal gender distribution, although more females are enrolled in environmental studies than males.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The ARTP centers directed by program faculty provide students the opportunity to conduct applied research, and also support student engagement and participation in conference travel and international research. The unique and cutting-edge approaches to studying and teaching about geoscience issues that are pursued by the Centers are highly regarded throughout the U.S., with our students having direct access to these pursuits. The program is unique in the Commonwealth in that it addresses in an integrative and technically oriented way critical anthropogenic challenges faced by Kentuckians, such as water, air quality, climate change (see the Kentucky Mesonet), mobility, and environmental pollution.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

As the local, regional, and global economies come to grips with anthropogenic challenges driven by climate change, Big Data, alternative energies, shifting and new technologies, and resource management, program majors are well positioned to provide skills and leadership in the Commonwealth and beyond over the next generation. Currently, there is a lower overall unemployment rate in the discipline than the national unemployment rate, and jobs are being created rapidly in those areas mentioned above. Every aspect of society is embracing geotechnical and geospatial techniques (agriculture, business, transportation, climate, logistics), and the program has realigned its curriculum to meet this potential demand going forward. The program already has interdisciplinary connections with Agriculture, Floodplain Management (Engineering), Education, Journalism, Public Health, and Sociology at WKU and is working diligently to engage other programs in sharing curricula opportunities that address anthropogenic challenges. Opportunities also exist for recruiting out-of-state and international students interested in the unique geography and environment of south-central Kentucky for research – we already benefit from the Meteorology and Master's programs' wide recruitment, as all these students must take core geography courses or advanced geo-environmental coursework. There are significant opportunities also for students interested in understanding the impact of the Commonwealth's changing economy.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Nationally, many programs are moving toward a geoscience model that involves interdisciplinary, applied teaching to incorporate globalization, geospatial analysis, and socio-environmental awareness. Our program aligns well with these trends and there is sustained growth as we keep up with technology, software, and applied learning experiences for our students. We provide access to learning tools and environments needed for students to graduate with a highly competitive skillset marketable in their field. Recently, programs are working to provide field experiences and internships, which we have successfully implemented over the past five years through myriad community and business partnerships, revised courses that include fieldtrips and field experiences (WKU Karst Field Studies), and trained through the Department's ARTP Centers by working in commercialized lab settings and with community governments and regional specialty sectors (i.e., agriculture, manufacturing, transportation) to gain practical experience and to position students well for jobs.

Nationally, geography and environmental studies programs now incorporate more technical and communication skills in the curriculum, as these are increasingly demanded by employers who must shift with a rapidly changing global economy. Our program has kept up with changes by restructuring courses, renaming for wider appeal, and incorporating more writing and technical training in the curriculum.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Though not yet evident through institutional data, we have implemented changes to increase productivity, success of students, and efficiency. These include:

- Developed new courses: Geography of Potent Potables, to complement the growing brewing and distilling industries in Kentucky; and Visualizing Geography, to address environmental changes facing the Commonwealth.
- Made multiple changes to upper-level environmental studies electives (see previous sections)
- Merged program #674 into #675 to incorporate environmental studies as part of the core curriculum and foci of the program to better prepare our students for demands in the job market.
- Developed 4-year program timetables so students can chart their program progress and keep on track to graduate in 4 years and with 120 hours. Through these changes, our average number of hours to completion has changed from 140 hours to 126 hours for majors.
- Changed teaching priorities for faculty to fill critical gaps in program and Colonnade needs
- Developed a marketing plan for our programs based on the aforementioned changes to increase the number of pre-declared majors in our program. Summer and Fall 2018 had the largest number of incoming, pre-declared Geography and Environmental Studies majors to date.
- These changes should drive up demand for the #374 Minor program.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

- Changes to the program majors that would now require a Minor program should invigorate the Geography Minor going forward.
- Outreach to other majors and other colleges should increase demand for this Minor going forward.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Food Processing and Technology
Reference Number:	1718
CIP Code:	011002
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Ogden College
College:	OCSE

Program Name:	Food Science
Reference Number:	1724
CIP Code:	01.1001
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	N
Minimum Hours Required:	12
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The College is suspending this program.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography & Geology
College:	ODGEN

Program Name:	Geographic Information Science
Reference Number:	576
CIP Code:	45.0702
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	53
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

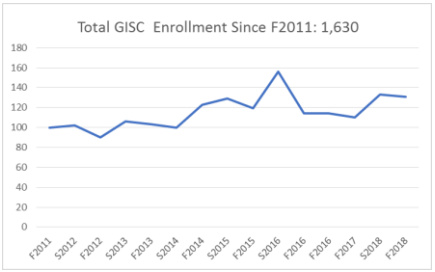
- Geographic Information Science (GIScience) is an emerging scientific discipline studying the theory, concepts, and effective use of GIS and geospatial technologies (e.g. maps, GPS, satellite, radar, drone, photogrammetry, surveying).
- GIScience prepares students to understand geospatial data structures and methods for capturing, modeling, processing, analyzing, and displaying geographic information and spatial patterns.
- WKU offers a comprehensive GIS curriculum with 12 GIS courses, including a general education colonnade course (GISC 216), two GIS foundations courses (GISC 316 and 317), eight GIS specialty courses, and one GIS practicum course.
- The program combines face-to-face and web courses; will soon offer an On Demand format.
- As an **interdisciplinary** major, non-GISC courses include CE, CS, GEOG, GEOL, METR, MATH, and AMS.
- It is a selective program because of its requirement in math and computer technology.
- WKU GIS curriculum is rigorous. Students must **earn a "C" or better in all GISC courses** in order to complete any GIS program offered (B.S., certificates, or minor).
- Students graduating from this B.S. program are automatically awarded the undergraduate Certificate in GIS.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	12	17	12	5	5	89
Conferrals	0	3	3	0	2	22
SCHP	166	172	131	63	124	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- The program goal is to train students with critical information processing and computer programming skills and to meet the needs of employers in **diverse industries with information-age needs**, which directly aligns with WKU's mission objectives.
- The requirement in the supporting non-GISC courses such as MATH and CS (e.g. Java) remains potential barriers and thus the B.S. program has low number of enrollment and conferrals.
- GISC courses are **highly popular** with academic disciplines across WKU because GIS is an applied problem-solving system used to improve many aspects of our lives. Students from **at least 34 WKU majors** have taken a 300-level GISC course.
- As an **interdisciplinary** field, GISC courses are support courses required by several programs at WKU:
    - B.S. Major: Workforce Administration, Biology, Civil Engineering, and Sociology (Research Methods track), Geography/Environmental Studies, Geology, Earth Science, and Meteorology;
    - Minor: Land Surveying, Computer Information Systems, Geography, and Flood Plain Management;
    - M.S.: Geoscience and Homeland Security;
    - Graduate Certificate: Scientific Data Analysis and GIScience.
- The program offers a popular colonnade course (GISC 216) in the Connections/Local-Global category.
- Since Fall 2011, the total number of students enrolled in GISC courses is 1,630, with a steady growth (see graph below).



c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

- The GIScience major was first offered at WKU in 2009, while the Certificate in GIS and GIS minor were offered in 2001 and 2006 respectively. During this period of expansion, **no additional faculty line was added**.
- GIS Instructor Scott Dobler received the Service to the GIS/Mapping Community award by the **Kentucky Association of Mapping Professionals** in 2018 due to significant contributions to Kentucky's GIS and mapping community.
- GIS Director Kevin Cary was twice nominated to Kentucky's Geographic Information Advisory Council, in 2018 by Travis Powell, General Counsel and Associate Vice President of KY CPE and in 2013 by WKU's provost.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	0	0	1	100.0%	1	100.0%	0	0	0	0	69.4%
Progression			13	69.2%	9	77.8%	4	50.0%	4	75.0%	61.3%
150% Graduation Rate	0	0	1	0.0%	1	100.0%	1	100.0%	0	0	
Time to Degree			4.89 (N=3)		4.00 (N=3)				7.50 (N=2)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

- We emphasize **project-based learning** in which students must apply GIS concepts and principles as well as demonstrate operational knowledge of GIS software. Students must demonstrate individual and group competencies, as well as demonstrate proficiency in communicating project results in written and graphic form.
- Outcomes are assessed based on students' ability to complete both independent and group projects in real-word settings. For instance:
    - The capstone course, GIS Analysis and Modeling (GISC 417), focuses on development and analysis of GIS databases. Students complete three group projects: one evaluates skills and knowledge acquired in prerequisite courses; one emphasizes modeling features with a variety of data formats, data creation and spatial geoprocessing; one is an applied project that enlists the full range of GIS techniques and technologies.
    - Students must engage with each other both within and across groups to complete the projects.
    - Each project has a written component with a focus on a different aspect of technical writing.
    - The capstone project also requires a group paper and production of a poster-sized map.
- Any incompetency or deficiency demonstrated by a group of students is discussed among GIS faculty. For example, when students' understanding of projection properties was found to be deficient, greater emphasis was placed on this topic in GISC 317, a prerequisite for GISC 417. GIS faculty members regularly meet to align teaching strategies and content among instructors and courses.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

- We remain in contact with graduates and their employers and keep a database of information on both.
- We have developed good working relationships with regional organizations that provide internship opportunities.
    - Feedback from graduates indicates that the internship is one of the most valuable components of the program, with some leading directly to full-time positions.
- Our graduates find employment in many application domains of GIS, including utilities, transportation, construction, environment, marketing, government, military, intelligence, consulting, and software development.
- From 2011-2017, all but one of 14 GIScience majors had a GIS position **before or within one month of graduation**.
- Because of their work-readiness via class projects, independent projects, and internships, many graduates are quickly promoted within their organizations. Several have obtained management positions within a few years of employment.
- Several organizations, including Fruit of the Loom, have created GIS units as a direct result of using WKU GIScience interns who were later hired. WKU's Planning, Design, and Construction Department created a GIS unit staffed by our graduates that uses geospatial technologies in planning facility management on WKU campuses.
- Eight majors became fully certified through the GIS professional licensing exam. Others in the certificate and minor programs also became fully certified.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

- We remain in contact with graduates and their employers and keep a database of information on both.

- WKU GIS program is a member of regional GIS consortium, a venue of information exchange among the academic, government and business sectors.
- Graduates often return to give talks in our GISC courses, professional development courses, and departmental seminars. These relationships reinforce internship opportunities and keep faculty updated on employer needs and trends.
- GISC courses are revised and updated, and new courses are developed based on feedback from graduates, employers, and emerging geospatial technologies. For instance, GISC 216 was developed to address the increasing incorporation of geospatial information in Internet, smart phone, mobile device, and social media applications. This course trains students with hands-on skills in mobile apps, web GIS, and location-based services in the area of survey, data collection, information processing, and mapping, all areas of growing employment.
- We are currently forming a GIS advisory board, so we can formally incorporate feedback from our graduates and regional employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

- Since 2003, an **average of two WKU GIScience students per year have won scholarships** (from a pool of 60 available for U.S. college students) for a week-long international GIS Conference attended by over 15,000 GIS professionals and professionals-in-training.
- Since the 2013 inauguration of the **Kentucky Association of Mapping Professionals**' $1000 student scholarship, **5 of 6 awardees** have been WKU GIS students.
- The program has successfully placed students as interns at many local businesses and agencies, including Fruit of the Loom, Bowling Green Police Dept., BGMU, Warren County Planning Commission, City of Bowling Green, FedEx, WKU, Warren County Water District.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.75	12
Number of NTE Faculty					2.00	4
Cost per SCH					$309.00 (IR) $172.21(GISC)	$128
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.2%	92.5%	75.8%
Median Class Size by Level	11	12	10	11	9	19
% Under-Enrolled Sections by Level	63.4%	63.8%	69.0%	60.9%	68.0%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

- All GIS courses are taught in two GIS computer labs. A lab fee, $50, is charged per student per regular (non-online) section. This is the main source of revenue in addition to tuition.
- We are in the progress of creating a GISC Certificate On Demand, paving the way for offering an online major and certificate nation-wide. This will bring DELO revenue to the program.
- We have developed good working relationships with organizations in the region which provide many paid internship opportunities. These relationships do not bring revenue directly to the program, but enable our students to gain work experience and help pay education costs.
- Students in GIS specialty courses are often involved in real-world projects. These service projects that bring limited revenues, but provide critical experience in real-world problem solving.
- Geography & Geology faculty teach across programs. The Cost per SCH value of $172 was calculated by summing the salary, research, and service costs for each faculty member teaching in the GISC program, in proportion to their contribution to that program, and then dividing that dollar figure by the total tuition generated by the GISC program. The true cost of GISC SCH is significantly lower than IR data suggest.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

- The capacity of GISC sections is limited by the number of computers in the two GIS teaching labs (which have 18 and 22 seats). We cannot offer large sections, so the program has higher cost per SCH than the university median.
- GISC courses are highly applied, technology-focused, and projected-based. The teaching is different from the conventional approach. It requires intensive interactions with students, another reason why the size of GISC sections, especially in upper-level courses, is smaller than the university median.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- GIS is a highly **applied** and fast-developing field that has experienced rapid job growth over the past decade and promises continued growth.
- The GIS programs contribute to WKU's goal as an **applied research university** as we educate, train, and prepare our students in critical thinking, innovative technology, professional development, and problem-solving skills.
- (Goal: **Regional lighthouse for resources and nurturing intellectual capital***)* The program offers undergraduate and graduate certificates in GIS for continuing education to match job market needs.
- (Goals: **Prepare students for success on the global stage; expand university outreach and service; bolster the regional economy)** Many of our GISC courses are taught via collaborative, project-based learning that contributes directly to the well-being of local and regional communities.
    - Students can directly employ what they have learned for solving real-world problems and experience first-hand the power of GIS technologies to improve communities.
    - Real-world project and internship experiences have enabled our students to find jobs faster and prepared them for future career advancement, with several achieving managerial positions within a few years of employment.
- Our graduates are de facto ambassadors for WKU GIS programs. Their job-readiness and successes on the job showcase the quality of WKU's GIS programs and graduates.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

- HB 1:
    - Goal 4: Both face-to-face and online GIS courses available.
    - Goal 5: Currently in process to establish a local KCTCS pathway to the GISC bachelor's degree (HB 160 in 2010).
    - GIScience program contributes to economic and social welfare goals of HB 1:
        - OBJ 2 & 3: helped increase the awareness of P-12 students of Kentucky in the roles of geospatial technology in society;
        - OBJ 6 & 8: educated and trained students in meeting the needs of students and employers in various GIS industries, organizations, and government agencies via project-based learning;
        - OBJ 8, 9, 10, & 11: This program has provided up-to-date teaching and training of geospatial technologies to students. Students and graduates utilize their geospatial skills for improving the quality of life in communities.
- Aligns with statewide postsecondary education strategic implementation plan by:
    - Partnering with Kentucky Geography Alliance: The leading GIS software was introduced to KY K-12 schools.
    - Project-based learning - **graduates from this program are well-trained, highly regarded, and in high demand** in the region and the Commonwealth.
    - All 4 core GISC courses currently online to be On Demand distance-learning courses.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

- GIS directly addresses workforce needs in the following general occupations:
    - Building, grounds (Land Information Systems), business, social services, computer, construction, education, farming, fishing, forestry, food services, healthcare support, installation/maintenance/repair, legal, life/physical/social science, management, office/administrative, personal care/service, production, protective service, sales, and transportation.
- The number of job openings in the locality/region is 17,875 and state is 93,095.
    - Office/administrative, transportation, food, sales, and production are the top 5 general occupation jobs.
    - GIS and spatial analytic software is strategic in the following industries:
        - Banking, education, electric/gas utilities, government, health/human services, insurance,
        - Manufacturing, natural resources, petroleum/pipeline, public safety, real estate, retail, state/local government, telecommunications, transportation, and water (Esri).
- GIScience jobs are **projected to grow 19%** from 2016 to 2026, **faster than the average for all occupations due to increasing use of maps, GPS-embedded devices, location-based services, and big data.** Entry level GIS jobs require a bachelor's degree (URISA & US Dept. of Labor).

- Amazon has selected Nashville for a new technical operations center. *The NY Times* reported 5,000 jobs to be created with average wage of $150,000. Due to wide use of GIS in operations, logistics, distribution, and marketing, we anticipate significant GIS job openings for WKU students.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

- WKU's GIS program has been the flagship in Kentucky, the **first to introduce GIS as a major, minor, and certificate**.
- WKU has **the only GIS program in Kentucky** with majority of GISC courses delivered by nationally certified GIS professionals (GISP).
- The GIS program at WKU offers the **most comprehensive GIS curriculum in Kentucky** and is unique in its emphasis on project-based learning.
- WKU was the **first university in Kentucky to offer a general education GIS course**, Geotechnologies in a Global Community (GISC 216). As a popular colonnade course, it teaches students to apply the power of geospatial technologies in their respective disciplines, including climate, biology, religion studies, and social studies. It remains the **only course of its kind in Kentucky.**
- GIS professionals recognized WKU's GIS program with **the Kentucky Association of Mapping Professionals' Excellence Award in 2009**. To this day, WKU GIS Program remains **the only GIS program among Kentucky's 4-year institutions** that received this award.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

- Employers in Kentucky, Tennessee, and the surrounding region recognize the quality of WKU's GIS program and seek out its graduates.
- Many WKU graduates with majors other than GIScience reported that their GIS classes have made the critical difference in securing their first job.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

- According to Statistics MRC, "**the Global Geospatial Analytics Market is expected to grow from $38.65 billion in 2017 to reach $174.65 billion by 2027 with a CAGR of 18.2%**. Need for reducing operational and logistic costs by organizations, technology advancement in artificial intelligence (AI) and commoditization of geospatial information are some of the key factors driving the market growth" (Statistics MRC)
- "Increasingly, businesses are turning to GIS to develop new markets … predict growth, improve efficiency of routes and services…" (Forbes.com). "Spatial transformers will play an important role in business success in the coming decades, and … executives are awakening to the power of location intelligence" (Esri).
- Geospatial technologies are rapidly becoming part of many job sectors, such as business, economics, political science, sociology, social work, biology, and forestry, agriculture, to name a few. The GIS program may more effectively reach students in these areas by offering a series of 5-week (1/3 semester) short-courses focused on applications in a single discipline. The hope is that, after seeing the potential for GIS applications within their chosen field, some students will opt to delve further into GIS courses, perhaps picking up a minor or second major.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

- Geospatial analytics combined with AI and cloud-based big data can provide better and less expensive solutions to organizations across the globe, with additional benefits, such as the ability to meet on-demand needs, increase data accessibility and analyze large, complex datasets and multiple types of geospatial information (Cision PR Newswire).
- GIS is a highly **applied interdisciplinary** field. GIS education and training requires preparing students with knowledge and skills in both academic fields and industry. Usually, GIS courses are taught by both academic researchers and applications specialists with experiences in GIS industries. **WKU GIS programs align with this national trend and have mixed tenured professors (2) and instructors (4).**
- Due to increasing demand for geospatial information in Internet, smart phone, mobile device, and social media applications, GIS and geospatial technologies are becoming increasingly essential in job markets. **Many WKU graduates with majors other than GIScience reported that their GIS classes have made the critical difference in securing their first job.**

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

- Starting in Spring 2019, GISC 316, which was a gatekeeper course for the major and minor, will no longer have Geography/Geology prerequisites. Those prerequisites were designed to sequence the course for majors in Geography and Geology yet acted as a barrier to students in other disciplines interested in the GISC minor or major. Sequencing within majors will now be handled through advising.
- The number of sections of GISC 216, a popular Colonnade course, was increased in 2016-2017 from 4 to 6 to meet high demand. Starting in Spring 2019, 4 sections per semester (**8 total per year**) will be offered. This will likely lead to more students taking higher-level GISC courses.
- Creation of an on-demand GISC certificate is in process. On-demand offerings will eventually be expanded to include the major, which would expand the potential student base to include technology professionals state- and nation-wide.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

- The Department is planning to consolidate the programs by combining three majors, namely, Geography/Environmental Studies, Geology, and GIScience into one major (**B.S. in Geoscience**). The new **Concentration in GIS and Geospatial Sciences** within the B.S. in Geoscience will replace the current B.S. in GIScience. This new concentration will continue to educate and train students emerging GIS and geospatial technologies, and allow them to take discipline-specific courses where GIS is widely applied. This change should also increase the possibility of students in other major programs having a second major in Geoscience.
- We expect majors (with a concentration in GIS and Geospatial Sciences), certificates, and minors to grow substantially.

- Most GIS majors and minors first encounter GIS in their sophomore or junior year at WKU, which is one of the main reasons why we have relatively low numbers of enrolled students and conferrals in the past a few years. We will do more K-12 outreach and make entering WKU students aware of GIS options.
- Lastly, we will increase our effort in interdisciplinary outreach. In the future, we will offer even more sections of GISC 216 per semester and reach more students in other disciplines.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☒ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography & Geology
College:	ODGEN

Program Name:	Geographic Information Science, CER
Reference Number:	#203
CIP Code:	45.0702
Degree Type (AB, BS, etc.):	CERT
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	9
List Concentrations (if any):	N/A

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

- Geographic Information Science (GIScience) is an emerging scientific discipline studying the theory, concepts, and effective use of GIS and geospatial technologies (e.g. maps, GPS, satellite, radar, drone, photogrammetry, surveying).
- GIScience prepares students to understand geospatial data structures and methods for capturing, modeling, processing, analyzing, and displaying geographic information and spatial patterns.
- Any graduate student who has successfully taken at least three graduate GIS/method courses is awarded with the Graduate Certificate in GIScience upon graduation.
- The program combines face-to-face and web courses.
- The graduate certificate program is designed to educate and train graduate students with advanced GIS skills and geospatial techniques so they can use GIS more effectively in their respective fields.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	2	1	0	0	2	4
Conferrals	4	1	1	2	1	5
SCHP	11	10	0.0	14	20	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- The program goal is to train students with critical information processing and computer programming skills and to meet the needs of employers in **diverse industries with information-age needs**, which directly aligns with WKU's mission objectives.
- WKU Geoscience M.S. Program now has a total of 6 GIS/method courses, including GEOS 517 Advanced GIS Databases, GEOS 520 Geoscience Statistical Methods, GEOS 523 GIS Applications and Geoprocessing, GEOS 575 GIS Modeling & Analysis, GEOS 576 GIS Programming, and GEOS 577 Selected Topics in GIS.
- One of the certificate courses, GEOS 520 Geoscience Statistical Methods, is a core Geoscience graduate course and required for all Geoscience graduate students.
- This certificate has been awarded to graduate students in the Geosciece M.S. program as well as other WKU graduate programs because GIS is an applied problem-solving system used to improve many aspects of our lives.
- There are **discrepancies** when comparing IR data on conferrals to our internal data. Our data show that there are a total of **10 conferrals** in the past 5 academic years, more than the number listed above.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree	Follows M.S		Geoscience		Degree		Data				

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

- We emphasize **project-based learning** in which students must apply GIS concepts and principles as well as demonstrate operational knowledge of GIS software. Students must demonstrate individual and group competencies, as well as demonstrate proficiency in communicating project results in written and graphic form.
- Outcomes are assessed based on students' ability to complete both independent and group projects in real-word settings. For instance:
    - The capstone course, GIS Analysis and Modeling (GEOS 575), focuses on development and analysis of GIS databases. Students complete three group projects: one evaluates skills and knowledge acquired in prerequisite courses; one emphasizes modeling features with a variety of data formats, data creation and spatial geoprocessing; one is an applied project that enlists the full range of GIS techniques and technologies.
    - Students must engage with each other both within and across groups to complete the projects.
    - Each project has a written component with a focus on a different aspect of technical writing.
    - The capstone project also requires a group paper and production of a poster-sized map.

- Any incompetency and deficiencies demonstrated by a group of students leads to a discussion with instructors teaching prerequisites for GEOS 575 and GIS faculty members regularly meet to align teaching strategies and content among instructors and courses.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

- We remain in contact with our graduates and their employers and keep a database of information on both.
- We have developed good working relationships with regional organizations that provide internship opportunities.
- Students with the graduate GIS certificate find employment in many of the application domains of GIS, including utilities, transportation, construction, environment, marketing, government, military, intelligence, consulting, and software development.
- Because of their GIS work-readiness via class projects and real-world experiences, the chances of graduate GIS certificate students have been greatly enhanced in seeking employment after graduation. **Many WKU graduates with degrees other than GIScience reported that their GIS certificates and classes have made the critical difference in securing their first job.**
- Many GIS certificate students became fully certified as GISPs after working for 4 years.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

- WKU GIS program is a member of regional GIS consortium, a venue of information exchange among the academic, government and business sectors.
- Some graduate GIS certificate holders return to give talks in our GISC courses, professional development courses, and departmental seminars. These relationships reinforce internship opportunities and keep faculty updated on employer needs and trends.
- Graduate GIS/method courses are revised and updated, and new courses developed, based on feedback from graduates, their employers, and emerging geospatial technologies.
- We are currently forming a GIS advisory board, so we can formally incorporate feedback from our graduates and their employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

- The graduate GIS program produces exceptional outcomes. In 2015, WKU graduate GIS certificate holder Ann Epperson (M.S. in Geosciences 2010) received the inaugural WKU Open Access Hall of Fame award for over 15,000 downloads, more than any other WKU thesis. Ann also won the 2011 Ogden College Outstanding Graduate Student award.
- Many graduate students credit their GIS skills and experiences as one of the main reasons that they found jobs quickly. Certificate holders are employed as GIS analysts in the fields of utility, transportation, climate studies, business analytics, data sciences, intelligence, surveying, consulting, etc.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.25	12
Number of NTE Faculty					0.25	4
Cost per SCH					$309.00 (IR) $172.21(GISC)	$128
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.2%	92.5%	75.8%
Median Class Size by Level	11	12	10	11	9	19
% Under-Enrolled Sections by Level	63.4%	63.8%	69.0%	60.9%	68.0%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

- All GIS courses are taught in two GIS computer labs. A lab fee, $50, is charged per student per regular (non-online) section. This is the main source of revenue in addition to tuition.
- We are in the progress of creating a GISC Certificate On Demand, paving the way for offering an online major and certificate nation-wide. This will bring DELO revenue to the program.
- We have developed good working relationships with organizations in the region which provide many paid internship opportunities. These relationships do not bring revenue directly to the program, but enable our students to gain work experience and help pay education costs.
- Students in GIS specialty courses are often involved in real-world projects. These service projects that bring limited revenues, but provide critical experience in real-world problem solving.
- Geography & Geology faculty teach across programs. The Cost per SCH value of $172 was calculated by summing the salary, research, and service costs for each faculty member teaching in the GISC program, in proportion to their contribution to that program, and then dividing that dollar figure by the total tuition generated by the GISC program. The true cost of GISC SCH is significantly lower than IR data suggest.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

- The capacity of GISC sections is limited by the number of computers in the two GIS teaching labs (which have 18 and 22 seats). We cannot offer large sections, so the program has higher cost per SCH than the university median.
- All graduate GIS/method courses are highly applied, technology-focused, and projected-based. The teaching is very different from the conventional approach. It requires intensive interactions with students, another reason why the size of GISC sections, especially in upper-level courses, is smaller than the university median.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- GIS is a highly **applied** and fast-developing field that has experienced rapid job growth over the past decade and promises continued growth.
- The GIS programs contribute to WKU's goal as an **applied research university** as we educate, train, and prepare our students in critical thinking, innovative technology, professional development, and problem-solving skills.
- (Goal: **Regional lighthouse for resources and nurturing intellectual capital***)* The program offers undergraduate and graduate certificates in GIS for continuing education to match job market needs.
- (Goals: **Prepare students for success on the global stage; expand university outreach and service; bolster the regional economy)** Many of our GISC courses are taught via collaborative, project-based learning that contributes directly to the well-being of local and regional communities.
    - Students can directly employ what they have learned for solving real-world problems and experience first-hand the power of GIS technologies to improve communities.
    - Real-world project and internship experiences have enabled our students to find jobs faster and prepared them for future career advancement, with several achieving managerial positions within a few years of employment.
- Our graduates are de facto ambassadors for WKU GIS programs. Their job-readiness and successes on the job showcase the quality of WKU's GIS programs and graduates.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

- HB 1:
    - Goal 4: Both face-to-face and online GIS courses available.
    - Goal 5: Currently in process to establish a local KCTCS pathway to the GISC bachelor's degree (HB 160 in 2010).
    - GIScience program contributes to economic and social welfare goals of HB 1:
        - OBJ 2 & 3: helped increase the awareness of P-12 students of Kentucky in the roles of geospatial technology in society;
        - OBJ 6 & 8: educated and trained students in meeting the needs of students and employers in various GIS industries, organizations, and government agencies via project-based learning;
        - OBJ 8, 9, 10, & 11: This program has provided up-to-date teaching and training of geospatial technologies to students. Students and graduates utilize their geospatial skills for improving the quality of life in communities.
- Aligns with statewide postsecondary education strategic implementation plan by:
    - Project-based learning - **graduates from this program are well-trained, highly regarded, and in high demand** in the region and the Commonwealth.
    - Many graduate GIS courses are currently online for distant learners

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

- GIS directly addresses workforce needs in the following general occupations:
    - Building, grounds (Land Information Systems), business, social services, computer, construction, education, farming, fishing, forestry, food services, healthcare support, installation/maintenance/repair, legal, life/physical/social science, management, office/administrative, personal care/service, production, protective service, sales, and transportation.
- The number of job openings in the locality/region is 17,875 and state is 93,095.
    - Office/administrative, transportation, food, sales, and production are the top 5 general occupation jobs.
    - GIS and spatial analytic software is strategic in the following industries:
        - Banking, education, electric/gas utilities, government, health/human services, insurance,
        - Manufacturing, natural resources, petroleum/pipeline, public safety, real estate, retail, state/local government, telecommunications, transportation, and water (Esri).
- Many fields use GIS as a problem-solving tool, and the GIS certificate positions graduates to be leaders within their disciplines with respect to application of geospatial technology.

- Amazon has selected Nashville for a new technical operations center. *The NY Times* reported 5,000 jobs to be created with average wage of $150,000. Due to wide use of GIS in operations, logistics, distribution, and marketing, we anticipate significant job openings for WKU students with GIS skills.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

- WKU's GIS program has been the flagship in Kentucky, the first to introduce GIS as a major, minor, and **certificate**.
- WKU has **the only GIS program in Kentucky** with majority of GISC courses delivered by nationally certified GIS professionals (GISP).
- The GIS program at WKU offers the **most comprehensive GIS curriculum in Kentucky** and is unique in its emphasis on project-based learning.
- Employers in Kentucky, Tennessee, and the surrounding region recognize the quality of WKU's GIS program and seek out its graduates.
- GIS professionals recognized WKU's GIS program with **the Kentucky Association of Mapping Professionals' Excellence Award in 2009**. To this day, WKU GIS Program remains **the only GIS program among Kentucky's 4-year institutions** that received this award.
- Many WKU graduate GIS certificate holders report that their GIS classes have made the critical difference in securing their first job.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

- According to Statistics MRC, "**the Global Geospatial Analytics Market is expected to grow from $38.65 billion in 2017 to reach $174.65 billion by 2027 with a CAGR of 18.2%**. Need for reducing operational and logistic costs by organizations, technology advancement in artificial intelligence (AI) and commoditization of geospatial information are some of the key factors driving the market growth" (Statistics MRC)
- "Increasingly, businesses are turning to GIS to develop new markets … predict growth, improve efficiency of routes and services…" (Forbes.com). "Spatial transformers will play an important role in business success in the coming decades, and … executives are awakening to the power of location intelligence" (Esri).
- Geospatial technologies are rapidly becoming part of many job sectors, such as business, economics, political science, sociology, social work, biology, and forestry, agriculture, to name a few. The GIS program may more effectively reach students in these areas by offering a series of 5-week (1/3 semester) short-courses focused on applications in a single discipline. The hope is that, after seeing the potential for GIS applications within their chosen field, some students will opt to delve further into GIS courses, perhaps picking up a certificate, minor or second major.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

- Geospatial analytics combined with AI and cloud-based big data can provide better and less expensive solutions to organizations across the globe, with additional benefits, such as the ability to meet on-demand needs, increase data accessibility and analyze large, complex datasets and multiple types of geospatial information (Cision PR Newswire).
- GIS is a highly **applied interdisciplinary** field. GIS education and training requires preparing students with knowledge and skills in both academic fields and industry. Usually, GIS courses are taught by both academic researchers and applications specialists with experiences in GIS industries. **WKU GIS programs align with this national trend and have mixed tenured professors (2) and instructors (4).**
- Due to increasing demand for geospatial information in Internet, smart phone, mobile device, and social media applications, GIS and geospatial technologies are becoming increasingly essential in job markets. Courses in the GIScience graduate certificate program provide graduate students with the options to learn and apply advance GIS and geospatial technologies.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

- We regularly update all graduate GIS/methods courses based on feedback from students and employers, the updates of GIS software, and the emerging geospatial technologies.
- For example, GEOS 577 Selected Topics in GIS was designed to enable graduate students learning other GIS software and emerging geospatial technologies.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

- The Graduate Certificate in GIScience was first offered in 2005 with the existing faculty of today. It has been consistent in terms of student enrollment and conferrals. The program should be maintained while the department has a vibrant graduate program.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography & Geology
College:	ODGEN

Program Name:	Geographic Information Systems, CER
Reference Number:	#174
CIP Code:	45.0702
Degree Type (AB, BS, etc.):	CERT
STEM+H Degree (Y/N)	N/A
Minimum Hours Required:	14
List Concentrations (if any):	N/A

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

- Geographic Information Science (GIScience) is an emerging scientific discipline studying the theory, concepts, and effective use of GIS and geospatial technologies (e.g. maps, GPS, satellite, radar, drone, photogrammetry, surveying).
- GIScience prepares students to understand geospatial data structures and methods for capturing, modeling, processing, analyzing, and displaying geographic information and spatial patterns.
- The undergraduate GIS Certificate consists of four courses: Fundamentals of GIS (GISC 316), GIS (GISC 317), GIS Analysis & Modeling (GISC 417), and GIS Programming (GISC 419). Any undergraduate student who has taken the above four courses **with grades "C" or above** is awarded with the Certificate upon graduation.
- The program combines face-to-face and web courses; and will soon offer an On Demand format.
- The program is designed to educate and train students with GIS skills, so they can use GIS effectively in their respective fields. This certificate has been earned by students in many disciplines at WKU.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	7	9	5	4	4	4
Conferrals	9	13	7	10	8	5
SCHP	156	135	87	82	97	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- The program goal is to train students with critical information processing and computer programming skills and to meet the needs of employers in **diverse industries with information-age needs**, which directly aligns with WKU's mission objectives.
- GIS certificate courses are support courses required by several programs at WKU:
    - B.S. Major: Workforce Administration, Biology, Civil Engineering, and Sociology (Research Methods tract), Geography/Environmental Studies, Geology, Earth Science, and Meteorology;
    - Minor: Land Surveying, Computer Information Systems, Geography, and Flood Plain Management;
    - M.S.: Geoscience and Homeland Security;
    - Graduate Certificate: Scientific Data Analysis and GIScience.
- GISC courses are **highly popular** with academic disciplines across WKU because GIS is an applied problem-solving system used to improve many aspects of our lives.
- GIS certificates have been awarded to students from **at least 34 majors at WKU**.
- There are **discrepancies** when comparing IR data on conferrals to our internal data. As stated before, any undergraduate student who has taken the above four courses with grades "C" or above is awarded the Certificate upon graduation. Our data show that there were a total of **68 conferrals** in the past 5 academic years, more than the number listed above.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

- GIS Instructor Scott Dobler received the Service to the GIS/Mapping Community award by the **Kentucky Association of Mapping Professionals** in 2018 due to significant contributions to Kentucky's GIS and mapping community.
- GIS Director Kevin Cary was twice nominated to Kentucky's Geographic Information Advisory Council, in 2018 by Travis Powell, General Counsel and Associate Vice President of KY CPE and in 2013 by WKU's provost.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	0	0	0	0	1	100.0%	0	0	0	0	73.7%
Progression			5	60.0%	2	0.0%	1	100.0%	2	100.0%	61.3%
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

- We emphasize **project-based learning** in which students must apply GIS concepts and principles as well as demonstrate operational knowledge of GIS software. Students must demonstrate individual and group competencies, as well as demonstrate proficiency in communicating project results in written and graphic form.
- Outcomes are assessed based on students' ability to complete both independent and group projects in real-word settings. For instance:
    - The capstone course, GIS Analysis and Modeling (GISC 417), focuses on development and analysis of GIS databases. Students complete three group projects: one evaluates skills and knowledge acquired in prerequisite courses; one emphasizes modeling features with a variety of data formats, data creation and spatial geoprocessing; one is an applied project that enlists the full range of GIS techniques and technologies.
    - Students must engage with each other both within and across groups to complete the projects.
    - Each project has a written component with a focus on a different aspect of technical writing.
    - The capstone project also requires a group paper and production of a poster-sized map.
- Any incompetency or deficiency demonstrated by a group of students is discussed among GIS faculty. For example, when students' understanding of projection properties was found to be deficient, greater emphasis was placed on this topic in GISC 317, a prerequisite for GISC 417. GIS faculty members regularly meet to align teaching strategies and content among instructors and courses.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

- It is relatively more difficult to maintain a database on GIS certificate students than on majors because they came from diverse programs. But we remain in contact with some students and their employers.
- We have developed good working relationships with regional organizations that provide internship opportunities.
- Students with the GIS certificate find employment in many of the application domains of GIS, including utilities, transportation, construction, environment, marketing, government, military, intelligence, consulting, and software development.
- Because of their GIS work-readiness via class projects and real-world experiences, the chances of GIS certificate students have been greatly enhanced in seeking employment after graduation. **Many WKU graduates with majors other than GIScience reported that their GIS certificates and classes have made the critical difference in securing their first job.**
- Several organizations, including Fruit of the Loom, have created GIS units as a direct result of using WKU GIScience interns who were later hired. WKU's Planning, Design, and Construction Department created a GIS unit staffed by our graduates that uses geospatial technologies in planning facility management on WKU campuses.
- Many GIS certificate students became fully certified as GISPs after working for 4 years.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

- We are in contact with our graduates and their employers.

- WKU GIS program is a member of regional GIS consortium, a venue of information exchange among the academic, government and business sectors.
- Some GIS certificate graduates return to give talks in our GISC courses, professional development courses, and departmental seminars. These relationships reinforce internship opportunities and keep faculty updated on employer needs and trends.
- GISC courses are revised and updated, and new courses are developed based on feedback from graduates, employers, and emerging geospatial technologies. For instance, GISC 216 was developed to address the increasing incorporation of geospatial information in Internet, smart phone, mobile device, and social media applications. This course trains students with hands-on skills in mobile apps, web GIS, and location-based services in the area of survey, data collection, information processing, and mapping, all areas of growing employment.
- In addition to the four required courses, GIS certificate students have the opportunity to take additional GIS courses to prepare themselves for future career advancement.
- We are currently forming a GIS advisory board, so we can formally incorporate feedback from our graduates and their employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

- Since 2003, an **average of two WKU GIScience students per year have won scholarships** (from a pool of 60 available for U.S. college students) for a week-long international GIS Conference attended by over 15,000 GIS professionals and professionals-in-training.
- Since the 2013 inauguration of the **Kentucky Association of Mapping Professionals**' $1000 student scholarship, **5 of 6 awardees** have been WKU GIS students.
- The program has successfully placed students as interns at many local businesses and agencies, including Fruit of the Loom, Bowling Green Police Dept., BGMU, Warren County Planning Commission, City of Bowling Green, FedEx, WKU, Warren County Water District.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.75	12
Number of NTE Faculty					2.00	4
Cost per SCH					$309.00 (IR) $172.21(GISC)	$128
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.2%	92.5%	75.8%
Median Class Size by Level	11	12	10	11	9	19
% Under-Enrolled Sections by Level	63.4%	63.8%	69.0%	60.9%	68.0%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

- All GIS courses are taught in two GIS computer labs. A lab fee, $50, is charged per student per regular (non-online) section. This is the main source of revenue in addition to tuition.
- We are in the progress of creating a GISC Certificate On Demand, paving the way for offering an online major and certificate nation-wide. This will bring DELO revenue to the program.
- We have developed good working relationships with organizations in the region which provide many paid internship opportunities. These relationships do not bring revenue directly to the program, but enable our students to gain work experience and help pay education costs.
- Students in GIS specialty courses are often involved in real-world projects. These service projects that bring limited revenues, but provide critical experience in real-world problem solving.
- Geography & Geology faculty teach across programs. The Cost per SCH value of $172 was calculated by summing the salary, research, and service costs for each faculty member teaching in the GISC program, in proportion to their contribution to that program, and then dividing that dollar figure by the total tuition generated by the GISC program. The true cost of GISC SCH is significantly lower than IR data suggest.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

- The capacity of GISC sections is limited by the number of computers in the two GIS teaching labs (which have 18 and 22 seats). We cannot offer large sections, so the program has higher cost per SCH than the university median.
- GISC courses are highly applied, technology-focused, and projected-based. The teaching is different from the conventional approach. It requires intensive interactions with students, another reason why the size of GISC sections, especially in upper-level courses, is smaller than the university median.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- GIS is a highly **applied** and fast-developing field that has experienced rapid job growth over the past decade and promises continued growth.
- The GIS programs contribute to WKU's goal as an **applied research university** as we educate, train, and prepare our students in critical thinking, innovative technology, professional development, and problem-solving skills.
- (Goal: **Regional lighthouse for resources and nurturing intellectual capital***)* The program offers undergraduate and graduate certificates in GIS for continuing education to match job market needs.
- (Goals: **Prepare students for success on the global stage; expand university outreach and service; bolster the regional economy)** Many of our GISC courses are taught via collaborative, project-based learning that contributes directly to the well-being of local and regional communities.
    - Students can directly employ what they have learned for solving real-world problems and experience first-hand the power of GIS technologies to improve communities.
    - Real-world project and internship experiences have enabled our students to find jobs faster and prepared them for future career advancement, with several achieving managerial positions within a few years of employment.
- Our graduates are de facto ambassadors for WKU GIS programs. Their job-readiness and successes on the job showcase the quality of WKU's GIS programs and graduates.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

- HB 1:
    - Goal 4: Both face-to-face and online GIS courses available.
    - Goal 5: Currently in process to establish a local KCTCS pathway to the GISC bachelor's degree (HB 160 in 2010).
    - GIScience program contributes to economic and social welfare goals of HB 1:
        - OBJ 2 & 3: helped increase the awareness of P-12 students of Kentucky in the roles of geospatial technology in society;
        - OBJ 6 & 8: educated and trained students in meeting the needs of students and employers in various GIS industries, organizations, and government agencies via project-based learning;
        - OBJ 8, 9, 10, & 11: This program has provided up-to-date teaching and training of geospatial technologies to students. Students and graduates utilize their geospatial skills for improving the quality of life in communities.
- Aligns with statewide postsecondary education strategic implementation plan by:
    - Partnering with Kentucky Geography Alliance: The leading GIS software was introduced to KY K-12 schools.
    - Project-based learning - **graduates from this program are well-trained, highly regarded, and in high demand** in the region and the Commonwealth.
    - All 4 core GISC courses currently online to be On Demand distance-learning courses.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

- GIS directly addresses workforce needs in the following general occupations:
    - Building, grounds (Land Information Systems), business, social services, computer, construction, education, farming, fishing, forestry, food services, healthcare support, installation/maintenance/repair, legal, life/physical/social science, management, office/administrative, personal care/service, production, protective service, sales, and transportation.
- The number of job openings in the locality/region is 17,875 and state is 93,095.
    - Office/administrative, transportation, food, sales, and production are the top 5 general occupation jobs.
    - GIS and spatial analytic software is strategic in the following industries:
        - Banking, education, electric/gas utilities, government, health/human services, insurance,
        - Manufacturing, natural resources, petroleum/pipeline, public safety, real estate, retail, state/local government, telecommunications, transportation, and water (Esri).
- Many fields use GIS as a problem-solving tool, and the GIS certificate positions graduates to be leaders within their disciplines with respect to application of geospatial technology.

- Amazon has selected Nashville for a new technical operations center. *The NY Times* reported 5,000 jobs to be created with average wage of $150,000. Due to wide use of GIS in operations, logistics, distribution, and marketing, we anticipate significant job openings for WKU students with GIS skills.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

- WKU's GIS program has been the flagship in Kentucky, the first to introduce GIS as a major, minor, and **certificate**.
- This certificate program started in 2001. It was a **first GIS certificate program in Kentucky** and was once showcased on the website of the world-leading GIS software company (Esri.com).
- WKU has **the only GIS program in Kentucky** with majority of GISC courses delivered by nationally certified GIS professionals (GISP).
- The GIS program at WKU offers the **most comprehensive GIS curriculum in Kentucky** and is unique in its emphasis on project-based learning.
- WKU was the **first university in Kentucky to offer a general education GIS course**, Geotechnologies in a Global Community (GISC 216). As a popular colonnade course, it teaches students to apply the power of geospatial technologies in their respective disciplines, including climate, biology, religion studies, and social studies. It remains the **only course of its kind in Kentucky.**
- GIS professionals recognized WKU's GIS program with **the Kentucky Association of Mapping Professionals' Excellence Award in 2009**. To this day, WKU GIS Program remains **the only GIS program among Kentucky's 4-year institutions** that received this award.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

- Employers in Kentucky, Tennessee, and the surrounding region recognize the quality of WKU's GIS program and seek out its graduates.
- Many WKU graduates with majors other than GIScience reported that their GIS classes have made the critical difference in securing their first job.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

- According to Statistics MRC, "**the Global Geospatial Analytics Market is expected to grow from $38.65 billion in 2017 to reach $174.65 billion by 2027 with a CAGR of 18.2%**. Need for reducing operational and logistic costs by organizations, technology advancement in artificial intelligence (AI) and commoditization of geospatial information are some of the key factors driving the market growth" (Statistics MRC)
- "Increasingly, businesses are turning to GIS to develop new markets … predict growth, improve efficiency of routes and services…" (Forbes.com). "Spatial transformers will play an important role in business success in the coming decades, and … executives are awakening to the power of location intelligence" (Esri).
- Geospatial technologies are rapidly becoming part of many job sectors, such as business, economics, political science, sociology, social work, biology, and forestry, agriculture, to name a few. The GIS program may more effectively reach students in these areas by offering a series of 5-week (1/3 semester) short-courses focused on applications in a single discipline. The hope is that, after seeing the potential for GIS applications within their chosen field, some students will opt to delve further into GIS courses, perhaps picking up a certificate, minor or second major.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

- Geospatial analytics combined with AI and cloud-based big data can provide better and less expensive solutions to organizations across the globe, with additional benefits, such as the ability to meet on-demand needs, increase data accessibility and analyze large, complex datasets and multiple types of geospatial information (Cision PR Newswire).
- GIS is a highly **applied interdisciplinary** field. GIS education and training requires preparing students with knowledge and skills in both academic fields and industry. Usually, GIS courses are taught by both academic researchers and applications specialists with experiences in GIS industries. **WKU GIS programs align with this national trend and have mixed tenured professors (2) and instructors (4).**
- Due to increasing demand for geospatial information in Internet, smart phone, mobile device, and social media applications, GIS and geospatial technologies are becoming increasingly essential in job markets. **Many WKU graduates with majors other than GIScience reported that their GIS classes have made the critical difference in securing their first job.**

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

- Starting in Spring 2019, GISC 316, which was a gatekeeper course for the certificate, will no longer have Geography/Geology prerequisites. Those prerequisites were designed to sequence the course for majors in Geography and Geology yet acted as a barrier to students in other disciplines interested in the GISC minor or major. Sequencing within majors will now be handled through advising.
- The number of sections of GISC 216, a popular Colonnade course, was increased in 2016-2017 from 4 to 6 to meet high demand. Starting in Spring 2019, 4 sections per semester (**8 total per year**) will be offered. This will likely lead to more students taking higher-level GISC courses.
- Creation of an on-demand GISC certificate is in process. On-demand offerings will eventually be expanded to include the major, which would expand the potential student base to include technology professionals state- and nation-wide.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

- The Certificate in GIS was first offered in 2001, the minor in GIS in 2006 and the major in 2009 with no increase in faculty lines. We expect growing demand for the GIS certificate as more disciplines realize the full potential of GIS.
- The Colonnade course, GISC 216, is offered for all majors to promote GIS potential to all WKU students, which helps recruit students into the certificate program. In the future, we will offer even more sections of GISC 216 per semester and reach more students in other disciplines.
- We will do more K-12 outreach and make entering WKU students aware of GIS options.

• We will increase our effort in interdisciplinary outreach. We plan to offer a series of 5-week (1/3 semester) short-courses focused on applications in a single discipline, such as business or public health.	
e. What recommendation would you put forward for the program (check one)?	
☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden College of Science and Engineering

Program Name:	Geography Education for Teacher Leaders
Reference Number:	#0444
CIP Code:	13.1205
Degree Type (AB, BS, etc.):	MAE
STEM+H Degree (Y/N)	N
Minimum Hours Required:	30-34
List Concentrations (if any):	none

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
This program is to be suspended.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden

Program Name:	Geography and Environmental Studies
Reference Number:	675
CIP Code:	45.0701
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	52
List Concentrations (if any):	Climate Systems, Environment and Sustainability, Geography, Karst and Water Resources, Tourism and Development

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The B.S. Geography and Environmental Studies degree is an interdisciplinary science program **concerned with preparing students for understanding complexities of human-environmental interactions through applied learning and effective use of geospatial and environmental technologies and data** (e.g., GPS, remote sensing, satellite, environmental quality monitors, surveying, etc.). The **program curriculum has evolved over time to emphasize substantive issues of globalization, cultural awareness, and sustainability**. It aims to produce broadly trained undergraduates through engagement in critical-thinking and meaningful problem solving. The program prepares students for career opportunities in the education, business, government, non-profit, and private consulting sectors.

Primary instruction is delivered face-to-face, although we offer On Demand and online sections of select courses. We also offer content through study abroad experiences. We incorporate meaningful research and community engagement in our program courses.

Our population is comprised of full-time students, though part-time and working professionals increasingly participate. There are no selective criteria for admission; we welcome students from all academic and diversity backgrounds.

The program does not require a second major or minor, though many students get a certificate or minor in Geographic Information Systems (GIS). Depending on their program concentration, students are required to take courses in MATH, CS, GIS, Chemistry, and Physics.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students #674/675	52	48	43	43	39	89
Conferrals #674/675	13	14	13	15	19	22
SCHP #674/675	697	659	747	710	691	991
TOTAL SCHP GEOG/GEOL	10,729	12,111	11,989	11,424	10,789	

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The goal of the program is to train students with critical geographic and environmental skills to meet the needs of employers in diverse sectors; this goal aligns with several of WKU's mission objectives. Program coursework **is inextricably Intertwined with METR, GEOL, GISC, and the Master's program through JUMP**. For example, GEOG 300 is required by all majors in any program offered through Geography and Geology. Program faculty teach across all five major programs.

Because of the interdisciplinary nature of the program, and the high demand for the applied skills taught through its coursework, students from multiple colleges and departments (such as education, agriculture, political science, journalism, history, social studies, engineering, and biology, etc.) participate in our program courses. Additionally, since every education major at WKU must take a Geography of Kentucky or History of KY course to complete the degree, approximately 100 elementary education majors are able to graduate WKU because of our program.

We offer courses in each colonnade category (Foundations, Explorations, and Connections). In total, we offer 23 colonnade courses, more than any other department in Ogden College.

The program has numerous students involved in WKU's honors programs, and it attracts both current and alumni Gatton Academy participants.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Founded in 1906, this degree program is one of the oldest geoscience programs in the southeastern U.S. Three years ago, the program (#674) was reconstituted as program #675, so productivity data are split between these program numbers. The rapidly changing dynamic of the global economy has led to highs and lows in the size of the program, but we strive to regularly adapt and restructure to meet the fluid and timely demands of the profession. Job prospects in geography and environmental studies are projected to grow over 25% over the next decade, faster than the national average for most occupations.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	5	100	1	100	7	90	2	100	3	33.33	69.4%
Progression			42	75	41	80	30	80	32	77.40	61.3%
150% Graduation Rate	10	50	4	75	1	100	2	100	4	75	
Time to Degree	4.54		4.78		4.25		4.00		4.19		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Intended Education Student Outcome #1
Students demonstrate engagement with the fundamental principles of research and writing in the geosciences and be able to articulate the principles of the scientific method.

Intended Education Student Outcome #2
Students can apply fundamental concepts, such as place, scale, region, and diffusion, that make up the "geographer's toolkit" for analyzing patterns of human and environmental activity around the world and identifying, mapping, and quantifiably assessing geospatial and environmental data.

Intended Education Student Outcome #3
Students can explain the complexities of social, cultural, and environmental diversity, and demonstrate critical thinking and evidence-based argument skills related to complex and nuanced real-world social, cultural, and environmental problems in a geographic context.

Means of Assessment for Outcome #1 Identified Above
All students must pass the research and writing intensive *GEOG 300 – Writing in the Geosciences* course, which requires students to produce a fully referenced research proposal.

Means of Assessment for Outcome #2 and #3 Identified Above
A comprehensive exam is given during the senior semester to all students completing the program. The exam consists of questions from the upper-division courses specific to each concentration. Additionally, all upper-level courses in the program require students to complete a comprehensive and discipline-specific essay or project that demonstrates applied skills.

Use of Results to Improve Instructional Program
Based on the above assessment strategies, we restructured the GEOG 300 course to include both written and verbal communication. Research and writing opportunities now are provided in each upper-level course to offer students more opportunity practicing research and writing in the discipline. Courses are more applied in nature so students have an opportunity to apply course content to solve real-world problems and conduct original research that directly benefits the WKU and broader south-central KY communities. Required preparatory courses have been restructured to incorporate current anthropogenic challenges.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Most alumni feedback comes from interpersonal communication with faculty. We remain in regular contact with our graduates and their employers and keep a database of information on both. There is no national exam for the B.S. Geography and Environmental Studies program.

Embedded in the exit exam of GEOG 499, our capstone course, is a survey that provides feedback on the nature of the program and career plans of students. An alumni survey is available on our website.

Approximately 25-30% of our students have applied for graduate school, with a 100% acceptance rate (with funding) in universities across the U.S.

U.S. News ranks geography at #7 in best science jobs, and the Bureau of Labor Statistics projects 11% job growth between 2016-2026 in environmental studies, which is faster than the national average. The skills and content learned through the degree program provide a lot of career flexibility, but students are overwhelmingly employed specifically within the geography and/or environmental studies fields. Students are employed in education, business, government, non-profit, and private sector consulting.

The *Twenty Fastest Growing Kentucky Occupations Generally Requiring a Bachelor's Degree* include two careers that program graduates are prepared for: Environmental Scientists/Specialists (change 38.24%) and Cartographers/Photogrammetrists (change 30.02%).

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Our faculty remain in constant communication with employers, public agencies in the region, and private corporations relevant to our students. This communication allows us to be responsive to market needs and builds relationships that help our students receive internships and gain employment. For example, locally, our faculty have ongoing meetings and projects with the City of Bowling Green, BGMU, EnSafe, and USDA, all of which have employed and/or offered internships to our students.

Feedback from graduates indicates that internships are one of the most valuable components of the program. **We have a 90% success rate with students being employed full-time with the organizations in which they completed an internship**.

Over the past 5 years, we have restructured program curriculum in response to feedback from employers and analysis of national trends in the field. For example, data suggested that students need more applied skills, better communication skills, and greater understanding of environmental regulations. As a result, each upper-division program course has an applied component, we developed seminar and field techniques courses to give students first-hand experience in the field, and we changed the environmental law, natural resource management, and environmental planning courses to better incorporate the information needed by today's employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The program has successfully placed students as employees/interns at multiple businesses and agencies, including Fruit of the Loom, BGMU, the City of Bowling Green, Oxford University (UK), USDA, WKU, University of Louisville, and Warren County Water District, to name a few. Local demand for student interns is beginning to exceed current supply, indicating potential for growth. The applied nature of our program allows students not only to contribute directly to geography and environmental studies problems, but also to build their portfolios for future employment. Because of their training, our students are successfully participating in study abroad, international research/internships, and conferences.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty	6.25	6.25	5.25	5.25	5.25	12
Number of NTE Faculty	3.25	3.25	3.25	3.25	3.25	4
Cost per SCH					$550.62 (IR) $95.74 (GEOG)	$128.00
SCHP/FTF by Dept. Major	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.2%	92.5%	76.80%
Median Class Size by Level ** TECHNICAL COURSES LIMITED BY LAB SIZE (IR DATA ARE FLAWED)	11	12	10	11	9	19
% Under-Enrolled Sections by Level ** TECHNICAL COURSES LIMITED BY LAB SIZE (IR DATA ARE FLAWED)	63.4%	63.8%	69.0%	60.9%	68.0%	36.30%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Over the past five years, more than $17 million dollars in grant and other revenue has been generated by the faculty and students of the Department. Due to the interdisciplinary nature of our programs, students from multiple programs, including the Geography and Environmental Studies program, have benefited from this revenue and have participated in the projects the funding supported.

Revenue from research centers affiliated with the Department, specifically Crawford Hydrology Laboratory and the Center for Human GeoEnvironmental Studies, as well as the Kentucky Geographic Alliance housed in the Department, is used not only to generate revenue for WKU, but also to support student research and training. These Centers employ or offer internships to an average of four undergraduate students, annually.

The Karst Field Studies program, part of the Geography and Environmental Studies curriculum, has brought over 3,100 students from 42 states and 17 countries since its inception, putting money into the local economy through housing, transportation, and food, and to WKU through tuition dollars paid.

Our programs have five endowed scholarships for students, with the majority of endowments coming directly from program alumni. Approximately 75% of our graduates donate at least $10 annually for the first five years post-graduation.

What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Because of the integrated nature of the programs in the department, it is difficult to separate data from the individual programs from data for the entire department. Faculty in the GISC/METR/GEOL programs also teach in GEOG. Many of our classes are capacity controlled (capped at 10-20 students) because of technology and lab capabilities, writing and reporting requirements, and the hands-on nature of the work. We team-teach Colonnade courses with other colleges, and generate significant Colonnade SCHs overall. IR data are distorted because we offer 1-3 hour internships and practicums (non face-to-face) that seem to be counted as regular courses.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The program contributes directly to WKU's goal as a teaching and applied-research university and to many aspects of WKU's strategic plan as we educate, train, and prepare our students in critical thinking, innovative technology, professional development, and problem-solving skills appropriate for workforce development.

We "facilitate continuing education, retraining, and degree completion, leveraging online resources and WKU's regional campuses" by offering courses in On Demand and online formats. We also support courses at regional campuses and offer dual credit courses with plans for offering additional dual credit courses in development.

The program supports the objective "Improve the quality of life regionally, and support regional economic diversification" and "prepare students for career and life in a global context." Many of our GEOG courses are taught via project-based learning and students often participate in collaborative projects that contribute directly to the well-being of local and regional communities. Students employ what they have learned in courses for real-world geospatial and environmental problem-solving and decision-making, and experience first-hand the meaningful outcomes possible through their discipline. Real-world project and internship experiences enable our students to find jobs faster and prepare them for future career advancement, with several achieving managerial positions within a few years of employment.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Objective 2, Strategy 2.2: Received funding from the National Geographic Society Education Foundation Grant, annually, to educate Kentucky teachers (both in-service and pre-service teachers) about geography and GIS.

Objective 2, Strategy 2.5: Offer both face-to-face and online courses. Implemented one dual credit course, with two other courses in development.

Objective 6, Strategies 6.1 and 6.2, and Objective 7: We have restructured the program, with plans to continue to do so, to better accommodate the "time to completion" of students transferring to WKU and changing majors. We work closely with KCTCS advisors to ensure students are prepared for our degree program, with pipeline strategies in place. Through these efforts, we have decreased our majors' total number of credit hours earned from 140 to 126 hours on average.

Objectives 9 and 10: Contribute to the economic and social welfare goals of HB 1 by educating and training students to meet the needs of the employers in various geospatial and environmental studies industries, organizations, and government agencies via project-based learning. Graduates from this program are well-trained, highly regarded, and in high demand in the region and the Commonwealth. We provide up-to-date teaching and training of geospatial and environmental technologies to students.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Kentucky is seeing growth in job sectors that relate to several geography and environmental studies fields, which all align well with the skillsets with which our students are graduating. Collectively, because of its wide applicability and the diverse nature of the discipline, the Geography and Environmental Studies program directly addresses the workforce needs for the following general occupations:

- Construction project management, education & training, farming, forestry and natural resource management, petroleum/pipeline, healthcare support, state and local government, water technicians, life/physical/social science, census technicians, sustainability coordinators, consulting, urban planners, environmental scientists, and transportation.

There will be over 2,000 job openings requiring geoscience expertise in Kentucky through 2021, which offers a high probability of employment, as well as high demand for the program for those seeking these employment types.

Due to the highly interdisciplinary and applied training provided through the program, graduates are competitive across a wide range of positions that integrate well with growing sectors in the state. Nationally, there are nearly 200,000 jobs projected through 2021 for geoscientists, so the program is also filling a need beyond just the state through its training.

The average wage for jobs related to the program is nearly $7,000 over the state mean.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The program is distinctive in its design, delivery, reputation, and regional impact. The Geography and Environmental Studies program **is the largest undergraduate program of its kind in the Commonwealth** and **the only program in Kentucky that incorporates a comprehensive approach to traditional geography, applied GIS, and environmental studies.**

Its Karst Field Studies summer courses are the **only field-based, comprehensive karst-specific courses offered in the U.S**. **Aside from WKU, only the University of South Florida offers a degree concentration specific to cave and karst science**.

Through its interdisciplinary and applied research/internship/study abroad requirements, students conduct projects and research about a variety of interconnected and complex geospatial and environmental studies issues in settings across the globe. **Employers in Kentucky, Tennessee, and the surrounding region recognize the unique comprehensive and applied nature of our courses, as well as the overall quality of the program, and seek out its graduates.**

Two Kentucky state geographers are from the program.

We support regional campuses, dual credit courses at Glasgow campus, online and On Demand offerings.

The faculty represent Asian, European, and Native American experiences, while majors come from nine different countries, with fairly equal gender distribution, although more females are enrolled in environmental studies than males.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The ARTP centers directed by program faculty provide students the opportunity to conduct applied research, and also support student engagement and participation in conference travel and international research. The unique and cutting-edge approaches to studying and teaching about geoscience issues that are pursued by the Centers are highly regarded throughout the U.S., with our students having direct access to these pursuits. The program is unique in the Commonwealth in that it addresses in an integrative and technically oriented way critical anthropogenic challenges faced by Kentuckians, such as water, air quality, climate change (see the Kentucky Mesonet), mobility, and environmental pollution.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

As the local, regional, and global economies come to grips with anthropogenic challenges driven by climate change, Big Data, alternative energies, shifting and new technologies, and resource management, program majors are well positioned to provide skills and leadership in the Commonwealth and beyond over the next generation. Currently, there is a lower overall unemployment rate in the discipline than the national unemployment rate, and jobs are being created rapidly in those areas mentioned above. Every aspect of society is embracing geotechnical and geospatial techniques (agriculture, business, transportation, climate, logistics), and the program has realigned its curriculum to meet this potential demand going forward. The program already has interdisciplinary connections with Agriculture, Floodplain Management (Engineering), Education, Journalism, Public Health, and Sociology at WKU and is working diligently to engage other programs in sharing curricula opportunities that address anthropogenic challenges. Opportunities also exist for recruiting out-of-state and international students interested in the unique geography and environment of south-central Kentucky for research – we already benefit from the Meteorology and Master's programs' wide recruitment, as all these students must take core geography courses or advanced geo-environmental coursework. There are significant opportunities also for students interested in understanding the impact of the Commonwealth's changing economy.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Nationally, many programs are moving toward a geoscience model that involves interdisciplinary, applied teaching to incorporate globalization, geospatial analysis, and socio-environmental awareness. Our program aligns well with these trends and there is sustained growth as we keep up with technology, software, and applied learning experiences for our students. We provide access to learning tools and environments needed for students to graduate with a highly competitive skillset marketable in their field. Recently, programs are working to provide field experiences and internships, which we have successfully implemented over the past five years through myriad community and business partnerships, revised courses that include fieldtrips and field experiences (WKU Karst Field Studies), and trained through the Department's ARTP Centers by working in commercialized lab settings and with community governments and regional specialty sectors (i.e., agriculture, manufacturing, transportation) to gain practical experience and to position students well for jobs.

Nationally, geography and environmental studies programs now incorporate more technical and communication skills in the curriculum, as these are increasingly demanded by employers who must shift with a rapidly changing global economy. Our program has kept up with changes by restructuring courses, renaming for wider appeal, and incorporating more writing and technical training in the curriculum.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Though not yet evident through institutional data, we have implemented multiple changes to increase productivity, success of students, and efficiency. These include:

- Developed new courses: Geography of Potent Potables, to complement the growing brewing and distilling industries in Kentucky; and Visualizing Geography, to address anthropogenic changes facing the Commonwealth.
- Made multiple changes to upper-level environmental studies electives (see previous sections for detail)
- Merged program #674 into #675 to incorporate environmental studies as part of the core curriculum and foci of the program to better prepare our students for demands in the job market.
- Developed 4-year program timetables so students can chart their program progress and keep on track to graduate in 4 years and with 120 hours. Through these changes, our average number of hours to completion has changed from 140 hours to 126 hours for majors.
- Changed teaching priorities for faculty to fill critical gaps in program and Colonnade needs
- Developed a comprehensive marketing plan for our program based on the aforementioned changes to increase the number of pre-declared majors in our program. Summer and Fall 2018 had the largest number of incoming, pre-declared Geography and Environmental Studies majors to date.
- Recently established an ambassador program for the majors.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

To use geospatial and environmental technologies and data effectively, students must be prepared with both technologies and domain-specific knowledge. The Department plans to consolidate programs by combining three majors - namely, Geography/Environmental Studies, Geology, and GIScience - into one major (B.S. in Geosciences). The new Concentration in GIS and Geospatial Sciences within the new B.S. in Geosciences will replace the current B.S. in GIS (#576). This concentration will continue to educate and train students in emerging geospatial and environmental technologies, data, and problem-solving while, concurrently, allowing them to take more discipline-specific courses in other geoscience fields such as geography and geology. This change should give WKU students more flexibility in choosing suitable coursework. This change should also increase the possibility of students in other major programs taking a second major in the Geosciences.

We continue to increase our efforts in interdisciplinary outreach, designing and teaching short courses that would engage students across the campus in the potential of geospatial and environmental studies technologies and data analysis. In the future, we will also offer even more sections of GEOG courses through dual credit and online formats. We anticipate a combined demand of at least 200 majors within the next ten years.

e. What recommendation would you put forward for the program (check one)?	
☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☒ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden College of Science and Engineering

Program Name:	Geology
Reference Number:	577
CIP Code:	40.0601
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	52
List Concentrations (if any):	None

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

WKU has the largest Geology enrollment (undergrad) and conferral numbers among schools in Kentucky. The Geology Program provides students (both traditional and those re-training for a new job market) with the professional foundation for investigating Earth's processes and materials, including identifying, understanding, and protecting/better utilizing Earth's resources (e.g., energy, water, minerals). Geology is ground zero for tackling global challenges like climate change, geologic hazards, and sustainable energy. **Our program is unique in the region for its emphasis on early immersion in myriad laboratory and field experiences, independent research, and for its capstone Professional Preparation course.**

Academic excellence of our program draws students from adjacent states and in some cases throughout the USA and even overseas. Our wide-spread and undergraduate student-centered engagements, which are rare in many universities, better prepare students for employment opportunities and graduate schools.

The Geology degree is instructed face-to-face in the classroom, laboratory and field settings, with a handful of online course offerings. This degree does not require a second major, minor, or certificate. To meet degree requirements, students need 16 hours of physics, chemistry and math from outside the department. This program has no admission cap or selective admission policy.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	27	24	27	30	~~30~~ 33 current	89
Conferrals	11	9	11	7	11	22
SCHP	375	339	442	505	524	991
Total Dept. SCHP	10,729	12,111	11,989	11,424	10,789	n/a

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- WKU-Geology leads the state in production of Geology majors; enrollment and conferral numbers are comparable to benchmark institutions. Overall **numbers are solid to growing, and total Department SCHP is substantial**.
- Aligning with WKU's mission and strategic plan objectives, Geology prepares students with critical skills to meet global employers' needs in diverse sectors including energy, water, climate, and industrial minerals.
- The program makes critical contributions both within and outside the department, particularly in STEM disciplines. A **minimum of 11 other programs/certificates** list GEOL courses in their requirements:
  - Major in Civil Engineering
  - Major in Electrical Engineering
  - Major in Geography and Environmental Studies
  - SKyTeach, Major in Middle School Science
  - Chemistry Major with Teacher Certification
  - Minor in Astronomy
  - Minor in Floodplain Management
  - Minor in Geography
  - Minor in Water Resources
  - Geographic Information Systems (GIS) Certificate
  - Minor in GIS
- We have **double-majors** [e.g., Civil Engineering, pre-law (environmental law), Chemistry].
- We have numerous student involvements in **WKU Honors** and **Gatton Academy**, and contribute to the **Geoscience graduate program through JUMP**.
- Our Program teaches six Colonnade courses (in Explorations and Connections): GEOL 103, GEOL 111, GEOL 112, GEOL 113, GEOL 114, and GEOL 315.

Over the period of IR data, we restructured our Program, suspending two tracks (including a major/minor B.S.), and creating #577 (this document) and #678; thus productivity data are split among these programs.

Quality production of SCH by our program is enhanced by the hands-on/laboratory/computer/field nature of Geology, necessitating smaller class sizes.

Enrollment in Geology programs can be dependent on market trends in resource-related fields. The petroleum industry is cyclic but maintaining; future. Geology jobs (e.g., environmental, geotechnical, geophysics, site characterization/assessment and remediation) are projected to grow by >14% by 2026 (Bureau of Labor Statistics), as infrastructure and environmental needs increase.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	0	0	0	0	0	0	4	100.0%	5	80.0%	69.4%
Progression	NA	NA	10	60.0%	21	81.0%	23	73.9%	19	84.2%	61.3%
150% Graduation Rate	0	0	2	0.0%	1	0.0%	1	0.0%	0	0	54.1%
Time to Degree	5.76 (N=11)		6.79 (N=8)		4.64 (N=11)		3.67 (N=7)		4.27 (N=11)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Student Learning Outcomes (SLOs) – Students will:

- Be proficient understanding the integrative nature of earth systems.
- Demonstrate skill analyzing geological field and lab data to solve specific problems related to earth science (e.g., find new natural resources, mitigate environmental crises or hazards).
- Integrate elective and core curriculum, demonstrating career or graduate school readiness.

SLOs were assessed through capstone course exit interviews and senior scores on the Area Concentration Achievement Test (ACAT) for geology. Over the period, our students positioned at or above national ACAT average, reflecting a consistent-to-rising level of student learning and program effectiveness. However, in recent assessments, we found students needed more exposure to real-world problem-solving skills. **Closing-the-loop, we took guidance from freely available resources developed by the National Association of Geoscience Teachers and the American Geosciences Institute** and incorporated more hands-on labs, including utilization of local sites and access to a wider variety of laboratory samples, in lower-level courses, and fieldtrips, real-world analytical labs using industry-standard equipment and software, and problem based learning (PBL) activities in upper-level courses. Through student-centered pedagogical activities including PBL and hands-on laboratory investigations, students gain research and critical/applied thinking skills into real-world problems. **As a result, employer requests for applications from our majors are frequent and consistent through time, demonstrating student success and a strong satisfaction with program graduates in the job environment.**

Moreover, based on student feedback, we moved to centralized program-advising, which should continue to increase numbers linked to 'success of students' (Table 3a).

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The Program systematically tracks students through personal connections/communication (emails, social media, professional conferences, surveys, requested letters of reference for employment/graduate school) and receives annual alumni and employer feedback as part of our capstone Professional Preparation course.

The latest survey of our graduates yielded following career/employment statistics (22 respondents):

Petroleum Industry: 26% Mineral exploration/extraction: 11% Environmental assessment-monitoring regulation/consulting: 32%	Natural resource management: 5% Geospatial industry: 11% Graduate School: 16%

Graduates with environmental-related and some energy sector jobs are required to have Professional Geologist status attained by a national exam (passing grade is 70%). Based on above statistics, 32% of graduates are either in process or have passed the exam. Graduate schools typically require good scores on the Graduate Record Exam (GRE), which is reflected in 16% of our alumni accepted to graduate school.

Alumni are guest speakers (an alumni advisory group) at our Professional Preparation course and speak on job attainment and trends/challenges of industry. Alumni provide feedback about the growing job market and industry requisite skills/experiences.

Destinations for recent graduates include: Devon Energy, OK; Mammoth Cave NP, Barrick Gold, NV; Schlumberger, LA; Lightwave Solar, TN; KY Geological Survey; University of Arizona (PhD); Syracuse University (PhD); Columbia University (PhD).

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The program elicits feedback from alumni-employers invited to present in Professional Preparation and Departmental seminars. Indications of employer satisfaction with the program are reflected in employer-alumni who regularly recruit from program graduates, and from significant financial contributions made by industry alumni (Section 4b paragraph 2). WKU Geology is well-known throughout the Commonwealth and beyond for the quality and preparedness of its graduates.

To ensure our program serves the needs of state, regional and national job availability, employment statistics are reviewed from the US Department of Labor, from professional organizations (American Geoscience Institute, Geological Society of America, AGU Career Center) and from the 2016-2026 Kentucky Occupational Outlook document (Kystats.KY.gov).

The program utilizes surveys and pedagogical resources from the National Association of Geoscience Teachers, and American Geosciences Institute to align program curricula with job market needs. Curriculum changes to entry-to-mid-level courses based on these resources included incorporation of more hands-on labs in entry-level courses, stronger emphasis on analytical analyses/problem solving in mid-to-upper level coursework, and an increase in instruction-based field trips.

A significant program change based on employer-feedback and review of job statistics is to replace the ACAT (student assessment) with the ASBOG I that starts students toward Professional Geologist certification.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Most students receive little introduction to Geology prior to college; thus we recruit majors from introductory-level courses. Fortunately, numbers of pre-declared majors started to rise (Table-3a, first data-row), partly for an increased social awareness of geology. **Once majors enter our program, they have high persistence year after year and excellent time to completion (Table-3a, second data-row). Both our retention and progression rates are much higher than university medians. Current time-to-degree is lower than the university median.**

Program graduates have high success rates finding either lucrative employment in the field, or acceptance to strong graduate programs around the country.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					4.75	12
Number of NTE Faculty					1	4
Cost per SCH					$545.04 (IR) $162.31 (GEOL)	$128
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.20%	92.50%	75.80%
Median Class Size, Upper Div	11	12	10	11	9	19
% Under-Enrolled (< 15 students) Sections, Upper Div **(Note: technical courses limited by lab size; IR data do NOT consider this.)**	63.4%	63.8%	69.0%	60.9%	68.0%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Over the five years, ~**$14 million in grant and other revenue was generated by Geology Program faculty and students**, most through corporate-university partnerships. These dollars support multiple departmental programs including faculty and graduate/undergraduate student research and conference travel, development of laboratory/teaching space, purchase of equipment, and licensing for industry-standard cutting-edge software. The Department generated ~$31k in summer DELO revenue.

Revenue from Geology alumni contributions of ~$30k, an additional $126k donation of equipment and the Lamping mineral and fossil collection, largely fund student travel for field and research experiences and conference presentations. Over the past two years, ~$80K in geophysical equipment was purchased through KY Division of Waste work at landfill via the WKU Geophysics Innovations Lab (GIL) with at least $20K in student payment or stipends. Approximately 75% of our graduates donate at least $10 annually for the first five years post-graduation.

The program faculty and students benefit from research collaboration, available laboratory facilities, and revenue and student employment opportunities associated with internal and external communities such as WKU research centers, including those affiliated with the Department, such as the Crawford Hydrology Laboratory and the Center for Human GeoEnvironmental Studies, and externally via the Kentucky Geological Survey, University of Kentucky.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Geology is a laboratory/field-based discipline, requiring hands-on experiences with specialized equipment. This necessitates lower class-sizes (10-20 students) in upper-division courses, distorting IR data significantly on cost, class-size, and enrollment. Continued growth of the program will necessitate new hires in future, as current SCHP-per-FTF is already high.

Our department generates significant Colonnade SCHs, and geology faculty contribute significantly to other programs. Almost all (92%) of our SCH is taught by FTF, compared to 75% for university (Table-4a); we are highly efficient, but for this, our cost-per-SCH is higher than university because part-time faculty are counted in SCH but not in cost.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The Geology program is strongly aligned with WKU's mission and directly addresses strategic priorities/metrics in the following areas:

1. In ***Research and Creative Activities,*** Program faculty secured ~$14 million in revenue. Research activities are student-centered and student-driven, with publication of peer-reviewed papers and presentations at local, regional and national/international conferences.

2. For ***A Regional Lighthouse,*** our Program:

   - Serves as a resource and partner to Mammoth Cave National Park (MCNP) with faculty involvement in resource management/research activities. MCNP, a natural laboratory, provides student learning/research opportunities.

   - Faculty engagement with local energy and environmental consulting industries resulted in alignment of program priorities with those industries, bringing unique scientific and environmental opportunities to students.

   - Graduates influence the conversation of economic development, environmental stewardship and sustainability as infrastructure is rebuilt, waste sites are remediated and "smart growth" is initiated in the WKU service area.

3. The ***Global Learning*** aspect is addressed by Program faculty with active international research and training projects in Asia, Africa, South America and the Caribbean, providing global perspective to courses as well as opportunities for students to participate in research abroad. Earth systems and resources know no political boundaries; we prepare all students for career and life in a global context.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Per Statewide Strategic Objectives:

2.2: Geology offers collaborative and problem-based learning courses for teacher certification to increase effectiveness of K-12 teaching (e.g., SKyTeach, Middle School Science Major).

6.1: Student Centralized advising provides consistency in program information for students, helps students maintain a progressive 4-year program time-table, identifies upcoming course needs to help faculty effectively align course offerings. Additional individual **faculty mentoring and monitoring of student progress, especially important for underrepresented, low-income, or first generation college students supports persistence to timely degree completion**. Graduating seniors receive career counseling from employed alumni.

9.1 & 9.2: Our Program advances KY's STEM agenda, and identifies current/emerging workforce demands. For effective career development/advising toward geology-related jobs, we promote regular feedback from practicing professionals which indicates graduates are well-prepared with relevant skills and knowledge for today's job requirements/career pathways.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Geology Program directly addresses key workforce needs in Kentucky and demand in the profession. We produce graduates in Kentucky Future Skills Report science sub-disciplines such as (five-year projected statewide needs noted):

geoscientists – 60 statewide, *environmental scientists or specialists* – 180, *physical scientists* – 24, *hydrologists* – 34, *geological and petroleum technicians* – 6, and *environmental science teachers* – 7, and contribute to graduates for needs in areas such as Engineering, Construction and Extraction, and other Physical Sciences. These sectors are growing. A majority of the jobs are in environmental- and engineering-related consulting and regulatory organizations such as under the KY Department for Environmental Protection including various divisions such as the KY Division of Waste, Underground Storage Tank branch and Abandoned Mine Lands, Division of Mine Reclamation and Enforcement organizations, private consulting, and the KY Geological Survey.

Almost all our graduates work in Geology and related areas, such as Earth materials, water or energy, thereby addressing workforce needs in a state possessing significant environmental issues related to energy and other extractive minerals industries.

Nearly 200,000 jobs are projected through 2021 for geoscientists nationally. In the oil sector, demand for geology jobs is projected to grow by >40% over the next decade (AAPG data source).

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

WKU-Geology has the largest enrollment (undergrad) and conferral numbers among Kentucky schools. In a recent prestigious geological competition (IBA), our student-team earned a **top 12 place among 192 universities around the world**, bringing international distinction to WKU. Program uniqueness among undergraduate offerings in the region and nationally is reflected in:

1) Engagement in ***one-on-one student/faculty research*** projects (GEOL 399, FUSE, RCAP). Students present research at national/regional and international professional meetings and research conferences.
2) ***"Early-immersion" courses*** focused on field-methodology, subsurface-modeling techniques, and analytical equipment-use and methods for intentional learning for career success.
3) Faculty-agency partnerships and University holdings that provide students unprecedented access to some of Kentucky's most significant "natural laboratories" including Mammoth Cave National Park, Crumps Cave Education and Research Preserve, Green River Preserve, and Machesney Field Station.
4) A ***capstone Professional Preparation*** *course* (GEOL 499), where students develop resumes/cover-letters, give a peer-reviewed presentation, and engage with WKU alumni who have successively moved on to geology-related jobs/graduate schools.
5) Exposure to ***diverse cultural/local experiences*** since the program hosts and employs internationally diverse faculty (in both origin and research-expertise) and has a mix of local and international students.
6) A higher-than-typical number of female faculty and majors for this discipline.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The program is aligned to provide students hands-on applied research experiences in energy and environmental consulting. Students participate in city, state and federal agency applied research projects/learning experiences. We support student engagement and participation in local, regional, national and international research conferences/agency meetings. **Geology is unique in the Commonwealth not only for its dual strength in addressing local and international geologic challenges but also by inclusion of students in the process.**

WKU-Geology teams finished first (2017) and second (2018) in the AAPG's Imperial Barrel Award (IBA) in the Eastern Section.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The Bureau of Labor Statistics projects geology-related job demand to grow 14% by 2026. This is reflected in ongoing national needs for energy and natural materials, natural-hazard mitigation, environmental protection, and stewardship of land/natural resources. National trends toward 'green energy' require identifying geologically acceptable locations for construction of wind farms, geothermal power facilities, and solar power plants. Demographic trends indicate people will migrate to geologically sensitive areas, so potential new markets for geological expertise are needed for assessment of volcanic-related hazards, earthquake potential, coastal-erosion impact, and water-resource issues. **Anticipated increased spending for improving national infrastructure will increase demand for geologists, especially with engineering-related backgrounds.** Cyclical job demand in the oil and gas industry is linked to fluctuations in commodity pricing, but expected upswing from current trends will result in the continued demand for geologists.

Revisions to increase the quality and demand of the Geology program should include interdisciplinary coursework connections (e.g., civil engineering, environmental studies/law, resource management, and hydrology) as well as development of more partnerships with emerging-trend industries to provide students with hands-on field and lab experiences. Both endeavors provide students with strong skills and experiences to be competitive in the job market.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Our department is trending toward the more interdisciplinary geoscience model that reflects academic as well as business/industry trends on the national level. The Geology program specifically addresses these trends by offering coursework in existing and emerging energy resources/needs, offering a variety of hands-on training in analytical and field methods that provide students with modern marketable job skills, and by preparing students for state and national professional accreditations required by the geoscience job market. The incorporation of geospatial as well as professional/technical writing coursework provides students with stronger technical and communication skills that are in demand nationally by employers.

Our students participate in regional and national competitions sponsored by sectors of the energy industry who donate proprietary state-of-the-art geo-analytical software and other analytical resources that are not normally available to the academic or private sector because of their high cost. Students are expected to develop enough competency with the software/analytics to identify and assess potential energy resources and to competitively communicate and defend their findings both in written and oral format. This gives our students hands-on experience with the current resources and expectations of the national energy industry, and provides opportunities for our students to network with potential employers.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Our program:

- Instituted new prerequisites to develop our student's geospatial and technical/professional writing skills (GISC 316-317 and GEOG 300).
- Consolidated student advisement such that one advisor now works with and tracks the progress of all geology majors. This provides consistency in program information communicated to students, helps students maintain a consistent 4-year program time-table, and identifies upcoming course needs of students to help faculty effectively align course offerings.

- Revised the program informational brochure to better reflect program offerings and opportunities.
- Revamped program displays and marketing materials which have been used at student recruiting events.
- Revised GEOL 485 – Geology of Fossil Fuels to allow undergraduates to participate in the Imperial Barrel Award (IBA) competition.

The above changes should increase the demand and productivity of the Geology Program.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The Department plans to consolidate programs by combining three majors – Geography/Environmental Studies, Geology, and GIScience – into one major (B.S. in Geosciences). A provisionally titled new Concentration in Geography and Geospatial Sciences will merge the current B.S. in GIS (#576) and B.S. in Geography and Environmental Studies (#675); two other concentrations will include Environmental Geoscience, and Professional Geology (an enhancement of the current #577 program). All three concentrations will contribute to professional certifications within their respective concentrations (e.g., GISP and Professional Geology (PG) certifications). The B.S. in Geoscience will likely require a minor which should give WKU students more flexibility in choosing suitable coursework and may even permit students from other majors to pick a second major in Geoscience.

Over the next five years, Geosciences (B.S.) will offer more sections of GEOL courses through dual credit and online formats, and the program will continue to offer courses that contribute to SKyTeach. Field courses in geological mapping and geophysics will also be established, and will be offered in connection with the Department's Karst Field Studies program. Over the next ten years, the Department anticipates a combined demand of at least 200 majors in the new B.S. major in Geosciences.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☒ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
5 January 2019

Department/School:	Geography and Geology
College:	Ogden

Program Name:	Geosciences M.S.
Reference Number:	072
CIP Code:	45.0701
Degree Type (AB, BS, etc.):	M.S.
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	N/A

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

- The M.S. Geoscience degree program embodies the spirit of WKU's mission by integrating an interdisciplinary, globalized, applied approach to preparing students at the graduate level and is one of only two programs in the Commonwealth under CIP code 45.0701. Academically, **the program is personalized and interactive**, requiring the work to be completed in residence for core courses, and creating an engaging, research-oriented, and outcome-driven experience that is adaptive to changing workforce and doctoral study demands through using the world as our laboratory and classroom.
- Our program is highly interdisciplinary and, through recruitment of local, regional, and international students, with funding when possible, has increased in diversity. The program engages **in applied research that contributes directly to improved quality of life and wellbeing of the community and campus,** focusing on projects that include both the human and physical environment locally, regionally, nationally, and internationally. Faculty and students seek external funding and work to support projects that invest funds and time back into society through applied research. The program recently increased admissions criteria requiring higher GRE scores and highly detailed letter of intent as we continue to increase the quality of the program.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	32	28	27	26	24	19
Conferrals	13	6	9	11	6	6
SCHP	342	341	314	332	298	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

- The program's interdisciplinary nature allows **contributions through applied research to all levels and aspects of the University mission**, including a multitude of committee members that are from outside departments, universities, and the private/government sectors.
- Currently, three JUMP students are enrolled, with two more having applied for admission, as several of the graduate-level electives are co-taught at the undergrad level, sparking recruitment for potential JUMP students.
- The program has broad reach internationally, both with international student enrollment (over 10% since 2013) and thesis engagement (nearly 25% have an international component, while nearly 50% have a local to regional emphasis.
- Nearly all electives in the program are combined with upper-level undergraduate courses to provide undergraduate mentoring and enhanced interdisciplinary interactions within the Department. For example, many students also earn a GIS certificate as part of their graduate program, as they are exposed to this in GEOS 520, a core course. Students from engineering, physics, biology, anthropology, history, education, chemistry, and other programs take our courses.
- Graduate students also provide support for teaching and assisting with undergraduate labs and introductory courses, thus gaining experience and allowing faculty to focus on generating external funding and conducting research.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The program has graduated nearly 100 students over the last decade and has a good conferral-enrollment rate on average. We honed graduation time to an average of 2.5 years since 2016, with alumni attending top schools for doctoral programs (Louisiana State, Michigan Tech) and getting lucrative, high-paying jobs at major companies and organizations (ExxonMobil, EnSafe, Kentucky Division of Water, National Park Service, National Forest Service, U.S.G.S., etc.). Our program is nationally known for its ability to produce employable graduates with real-world problem solving skills. We continually restructure the program with annual course reviews and direction to meet changing market demands.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate		100		100		100		100		100	82.2
Progression	7	85.7	6	83.3	7	85.5	5	100	11	90.9	N/A
150% Graduation Rate	6	50	7	42.9	6	50	7	71.4	5	100	N/A
Time to Degree	3.53		4.14		3.06		2.57		2.07		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

- Students graduating for the geoscience program develop an applied skillset and breadth of knowledge about the complexity and diversity of local and global human-environmental interactions, as well an appreciation and understanding of geospatial relationships and using technology to study them.
- Using the evidence and argument approach, students who graduate with a geoscience degree have learned how to become critical thinkers with marketable communication, analytical, and problem-solving skills that meet the needs of the citizens of the Commonwealth of Kentucky and the world.
- Students can demonstrate the capacity to apply geospatial, geological, meteorological, and/or environmental knowledge and training to address relevant concerns in community or society.
- Since the last review, we have increased the rigor of our admissions process (increased the minimum GRE score, and required a clear research statement), and established a graduate committee for admitting applicants.
- Students in the foundational Geoscience Research and Literacy course must demonstrate competency in writing, critical thinking, research development, and time and project management.
- In the Geoscience program, for example, foundational courses typically focus on research literacy and written communication, while advanced courses typically emphasize written communication, problem solving, and teamwork.
- In the graduate thesis, integrative learning becomes critical, as do creative and critical thinking.
- Second, students must complete a comprehensive written examination and defend their research publicly in a seminar presentation and in front of a graduate committee. Other assessment methods include experiential surveys, benchmark knowledge surveys at the beginning and end of individual courses, group projects and evaluations, independent student learning, practical experiences.
- Finally, students must complete a research thesis that is assessed (juried) by a committee of three or more faculty. Publication of the thesis research is expected.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The program's focal areas are **constantly being reviewed to ensure they align with employer needs and national trends in the Geosciences**; these are obtained through the American Geosciences Institute (AGI) and other related professional organizations (Esri for GIS, Geological Society of America, Association of American Geographers). Faculty maintain contact with program graduates, often having them return as speakers to the core graduate class (GEOS 500) to provide insight on future employment opportunities for current students, as well as to consult with faculty on evolving discipline needs. We informally monitor graduates who seek professional designations (Professional Geologist, GIS Professional) after graduation to track their success, with most achieving their goal within 3-5 years of graduation. Doctoral program acceptances since 2013 are 100% for those who applied and are currently in, or have completed, a Ph.D. in the Geosciences. **Key areas of professional growth, which are also focal points of our program, include energy, water resources, environment/sustainability, geophysics, and GIS.** KYSTATS reports a 5-to-14% growth in the Geosciences (varies by subfield) in Kentucky, while AGI suggests a national shortage of 135,000 geoscientists through 2022, with demand for M.S. degrees for high-paying jobs, suggesting our M.S. program aligns well with future needs.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The program's faculty constantly interact with potential employers and doctoral program advisees, as well as a broad

network of alumni, to seek critical feedback on changing workforce and academic demands. Alumni visit the Department each semester and provide several local and regional linkages to ensure employability and relevant training for students. **Each year, we review the program course offerings, continually updating the 5-year rotation to meet the needs for technical skills and academic preparation.** For example, we recently adjusted the program to offer more field-based courses integrating applied technology and software utilization (e.g., water resource management, field techniques using advanced equipment; training with industry-standard software for future geologists; and using the most advanced version of ArcGIS and applied course themes to bridge discipline-specific training with software skills). Based on feedback from graduates from the 2016 cohort, we restructured the GEOS 502 Research Methods course to better integrate interdisciplinary and hands-on experiences to prepare students with real-world experiences related to methods used in their field, which is trending in both the public and private Geoscience sectors to meet project managements' needs. We are developing an exit survey to collect data from graduates on future employment and plans for all alumni.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Our program has a relevant curriculum and high demand for our graduates in the workplace, exemplified by a recent graduate hired by ExxonMobil with a six-figure salary. Word about the quality of our graduate program and the continued success of our students in Ph.D. programs and the workforce after graduation are boosting our visibility and recruitment. Recent graduates hold leading positions within the National Park Service, Census Bureau, National Forest Service, Kentucky EPA, Kentucky Division of Water, and elsewhere regionally and nationally in competitive, highly influential jobs that guide policy, enhance quality of life, and generate jobs in other sectors.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					2.25	12
Number of NTE Faculty					0.25	4
Cost per SCH					$177.25	$128
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6	90.2	88.1	85.2	92.5	75.8
Median Class Size by Level **Note:** these data are erroneous as independent one-on-one courses are counted here. The median **class size is 6-10** students.	1	1	2	1	1	8
% Under-Enrolled Sections by Level	93.80	78.60	92.90	86.40	92.60	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program benefits from an active group of graduate faculty who secure external funding through grants, contracts, and commercial revenue through a variety of sources, including federal (USDA, USGS, NSF, NPS, NOAA), state (various), and local (City of Bowling Green, Butler County) sponsors, as well as private sources (various). The majority of these funds are used to support graduate stipends and tuition waivers for an average of 15-18 students per academic year. Additionally, the program benefits from revenue generated by faculty who lead three ARTP centers (CHNGES, Crawford Lab, Kentucky Climate Center), which also provide substantial funding for graduate students and their research. Collectively, faculty have generated around $20 million in external funding, as well as over $100,000 in internal grants, to support the program and continue to provide competitive support for recruiting students. Graduate students in the program have secured over $250,000 of funding for research projects since 2013, with an increasing number of student grant opportunities in the Geosciences. Collectively, external sources provide about 50% of the funding for students in the Department, increasing annually for the past three years. Current pursuit of cooperative partnerships to fund graduate students show promise, with three current collaborations funding students full-time.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Community engagement is a large component of the M.S. Geoscience program, wherein our students are directly involved in project-based research with local governments, consulting firms, federal agencies, etc. to solve real problems as part of their thesis research and often beyond. Our faculty continue to do more with less, while our focus remains on personalized, experiential learning that values faculty-student interactions over diluted class sizes. Applied research experiences give our students an advantage, including learning technical skills in the classroom, where many courses are combined with undergraduate sections to enhance mentoring experiences and teach graduate student project management skills.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- The M.S. Geoscience degree program **embodies the spirit of WKU's mission by integrating an interdisciplinary, applied approach to preparing students at the graduate level**. Our program is poised to contribute to the goals of:
- *Global Learning*- many of our students conduct international research,
- *Quality of Life*- the program creates an engaging, research-oriented, and outcome-driven experience that is adaptive to changing workforce and doctoral study demands. Recruiting qualified and productive faculty and students and providing a course structure and opportunities for local, national, and international research and learning experiences at the graduate level allow us to meet these objectives. This goal is achieved through applied research that contributes directly to improved quality of life and wellbeing of the community and campus, focusing on projects that include both the human and physical environment on campus, locally, nationally, and internationally.
- *Regional Lighthouse*: Many theses involve collaboration with the community and regional partners and contributions to P-12 education through outreach activities. Our students provide service by using their research to make positive change throughout the world, such as a recent graduate creating a new GIS division at Fruit of the Loom, generating jobs and improving economic stability in the region.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

- *Objectives 9 and 10*: Geoscience graduate faculty lead a variety of applied field experiences for students, such as visits to geologic outcrops, water systems, urban settings, cave and karst areas, and extreme learning environments (storm chases, flood zones), ranging from local to international locations, to improve their growth and understanding of classroom concepts as they apply in the real world. This hold especially true for bringing skills back to Kentucky in areas like tourism development, urban planning, and flood management, which improve the region's economy and add jobs, and increase the quality of life. We encourage students to publish their research, thereby contributing to their discipline, and to be innovative in their research in order to contribute to solving problems and produce meaningful outcomes that translate into positive real world changes.
- *Objective 11* is met by Geoscience graduate faculty fostering outreach partnerships in the region, each designed to improve the quality of life in Kentucky communities. For example, we have partnered with the Bowling Green Public Works Department to develop a groundwater/stormwater quality education campaign (UnderBGKY) through real-time data monitoring, workshops, school outreach, etc. The project and partnership was named a "Model Practice" among the National Organization for Public Works.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Kentucky is seeing growth in job sectors that relate to several Geoscience fields, including GIS, meteorology, and environmental consulting, which all align well with the skillsets with which our students are graduating. Collectively, the Geoscience field contributes to jobs in the following sectors:

- Geologists, hydrologists, urban planners, environmental scientists, natural resource managers, geographers, teachers, GIS professionals, census technicians, sustainability coordinators, water technicians, construction management, consulting, and others

There will be over 2000 job openings requiring Geoscience expertise in Kentucky through 2021. The Geoscience field offers a high probability of employment compared to the number of Geoscience graduates in the State. There is high demand for the program by those seeing this type of employment; average wage is nearly $7,000 over the state mean. Due to the highly interdisciplinary and adaptive training provided through the M.S. program, graduates are competitive across a wide range of positions that integrate well with growing sectors in the state, including manufacturing (e.g., logistics coordination, geologic resources), healthcare (e.g., water resources, environmental services), and education, among others. Nationally, there are nearly 200,000 jobs projected through 2021 for Geoscientists, so the program is also filling a need beyond just the state through its training.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The M.S. Geoscience program at WKU was one of two graduate programs in the Commonwealth under the 45.0701 CIP code in 2011-12 (the other is the University of Kentucky, but it is a Geology M.S. degree). **Currently, WKU is the only truly interdisciplinary geoscience graduate program with a thesis-only option for graduation** and ranks well with other programs

at benchmark universities with regard to the program requirements and quality of our graduates. Other departments offer master's level programs, but have limited concentrations (Murray State offers four concentrations in physical science and a non-thesis option). The University of Louisville offers an Applied Geography M.S., but is limited in focus and also offers a non-thesis option. Our program is the only one to integrate four related disciplines (geography/environmental studies, geology, meteorology, and GIS) along with applied research requirements to earn a degree requiring an interdisciplinary approach that welcomes students from all backgrounds and allows them to conduct research in any setting across the globe. The program produces a relatively high number of graduates compared to benchmark institutions with similar programs. We target all students with a highly visible reputation as evidenced by the diversity of students having graduated in the past decade.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The program is strategically aligned statewide, nationally, and internationally through its activities, including the recognition of the Kentucky Mesonet as the leading state climate entity, international agreements emphasizing student engagement in multiple countries (Iceland, Vietnam, Belize, etc.). In addition the Department has the only university-based commercial hydrology and EPA-certified water quality labs providing applied, real-word training for students. The program funds over 50% of its students from local, state, and federal sponsors for research directly related to theses, demonstrating its visibility at all levels as a recognized leader in the Geosciences across multiple sectors seeking well-trained graduates.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

Currently, the fields of energy, environmental education, GIS, geophysics, applied meteorology, and groundwater management are growing. These are strengths within the M.S. program and areas in which additional resources and reworking, particularly focusing electives and increased funding for recruitment to enhance competitiveness, would allow the program to maintain and even grow. Demand is already high and growing for the program, with many applicants coming from outside the region and internationally, while new connections with industry and local partners are providing avenues of recruitment and job placement. The field of karst geoscience, emphasizing groundwater quality and quantity and climate change, has always been a niche for the Department, and continues to grow in demand and job availability, while we boast the highest concentration of faculty with this expertise in the country. Additionally, interdisciplinary courses in GIS combining application of the tool with discipline specific topics could be highly marketable as these fields grow within private industry (e.g., recent success at BGMU, Fruit of the Loom, and local startups). Looking forward, the program can benefit from better integrating its diverse concentrations into cross-trained, interdisciplinary graduates with applied skills spanning the geosciences to be marketable globally.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

Nationally, many programs are moving toward a Geoscience model, which involves interdisciplinary, applied teaching to incorporate globalization, geospatial analysis, and socioenvironmental awareness. Our program aligns well with these trends, albeit suffering from the same decline in enrollment as most other programs nationally as the sciences continue to be underfunded and job growth changes within the sector with emerging technology; however, in the areas in which the program and its faculty specialize, such as groundwater, geophysics, environmental education, applied meteorology, and GIS, there is sustained growth and we succeed in keeping up with technology, software, and applied learning experiences. We provide access to learning tools and environments needed for students to graduate with a highly competitive skillset marketable in their field. Over the past 5 years, our programs worked to provide field experiences and internships that have been successfully implemented through myriad community and business partnerships. Revised courses include fieldtrips and field experiences (and programs like WKU Karst Field Studies), and training through the Department's ARTP Centers. Students work in commercialized lab settings and with community governments and regional specialty sectors (i.e. agriculture, manufacturing, transportation) gaining practical experiences that position them well for jobs upon graduation.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

- Since 2015, we have increased the rigor of our admissions process (increased the minimum GRE score requirement, require a letter of faculty support and clear research statement), and established a graduate committee for admitting applicants.
- The program was also restructured to emphasize the core courses and remove the concentrations and better customize the required electives to meet the students' needs within our interdisciplinary field. This includes providing more electives and opportunities for internships. We now have advisor mentoring guidelines, student responsibility and expectation guidelines, and a stream-lined 4-semester program sequence for students to follow in order to complete their program on time.
- A student handbook with clear formatting, committee structuring, and thesis research milestones and instructions was written. These changes were driven by a desire to reduce time from admission to graduate to no more than two years for full-time students. This document is updated annually based on student feedback, changes at the graduate school level, and observations by the graduate committee and thesis advisors. Lastly, we appointed a dedicated Graduate Coordinator to assist in unifying the course sequencing, admissions process, program advising, student recruitment activities, and graduation planning for our students.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

In five to ten years, the program has the potential to grow in emerging fields of energy/water resources, sustainability, GIS, geophysics, applied geology, and applied meteorology, most of which are already its strengths. Our faculty continue to do more with less, which is not for lack of success and effort on their part, nor for a lack of engaged and high quality students,

but primarily from needing additional funding and workload support from the institution to sustain a viable and productive graduate program fueled by external funding sources and focused on applied research. In refocusing our undergraduate programs to be collectively aligned under a broader Geosciences degree, we will increase our visibility as a Department through an improved identity across the board, better recruit JUMP students from multiple subdisciplines, and strategize to improve our workload model to allow flexibility for faculty pursuing external funding and advising higher numbers of graduate students. We will continue striving for success through creative efforts to seek funding and recruit students based on those efforts, albeit with a smaller cohort of more admissible, strong students based on tighter admissions, improved program advising, and more efficient course sequencing; thus, we strongly recommend the program is maintained.
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Physics and Astronomy
College:	Ogden College of Science and Engineering

Program Name:	Homeland Security Sciences
Reference Number:	413
CIP Code:	300101
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	y
Minimum Hours Required:	31
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The multidisciplinary graduate degree program in Homeland Security Sciences prepares science professionals and technology leaders for careers in Homeland Security, a robust and growing cross-cutting discipline. The program uses applications of physics, biology and chemistry to detect, quantify, prevent, and decontaminate chemical, biological, radiological, nuclear, and explosive (CBRNE) threats. The program leads to a thesis-based Master of Science degree in Homeland Security Sciences and requires a minimum of 31 semester hours beyond a Bachelor's degree. The program's curriculum features a required hands-on research component, which enables students to apply their training to real-world problems.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	9	7	9	8	7	19
Conferrals	5	2	2	2	3	6
SCHP	91	57	89	73	73	352

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

As in any strong graduate program, a fully symbiotic relationship exists between our graduate students and department activities. As is the norm in STEM graduate programs, the program provides full support to program participants either through internally funded graduate teaching assistantships (GTA) or through externally funded graduate research assistantships (GRA). These experiences are central to the graduate student's development as scientists regardless of whether they choose academic or industrial careers. In return, these GTAs and GRAs are crucial to meeting our teaching and research missions. GTAs provide quality instruction in the PHYS 256 and 266 laboratories (as instructor of record once they are SACSCOC-eligible with 12 hours of graduate coursework), thereby allowing faculty to pursue research and/or teach other classes. GRAs assist in completing applied research projects, most of which are externally funded, and that research also forms a substantial component of their master's theses.

Contribution to the mission of Ogden College of Science and Engineering:

Through the active engagement of program participants in a multidisciplinary curriculum, culminating in a thesis experience that involves a relevant hands-on research project, the Homeland Security Sciences graduate program is a key element in Ogden College's mission of "empowering individuals to become leaders though academic achievement, global connections and engagement in research, education and service."

Contribution to the mission of the Department of Physics and Astronomy:

The MS in Homeland Security Sciences is an important program in the department helping us to achieve our mission of "fostering a diverse international community of faculty, staff and students through engaged learning and significant research, stimulating intellectual curiosity and critical thinking."

We aim to:

1. Suitably prepare the next generation of scientists, engineers and health professionals;
2. Increase understanding of the physical universe in the local community and beyond; and
3. Conduct research that both enables these aims and has positive impact in the local and regional community and beyond."

These goals are met through a rigorous and interdisciplinary curriculum which culminates with the students producing a master's thesis related to a contemporary research topic in the discipline.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The hallmark of a strong graduate program is that students enrolled in the program not only earn knowledge, skills, and a valuable credential with which to pursue careers, but also that they constitute an effective "bridge" population, coupling the teaching and research missions of the institution. Students in the Homeland Security Sciences program not only facilitate state-of-the-art externally-funded research projects, leading to peer-reviewed publications and the advancement of knowledge in this very actve field, but also, under the advisement of carefully-selected faculty members, provide highly effective instruction in the Physics undergraduate laboratory sequence.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	6	83.3	1	100	1	100	1	100	1	100	n=595 82.2%
Progression											
150% Graduation Rate	1	100	6	83.3	1	100	1	100	1	100	n=505 73.3
Time to Degree	1.67 (N=5)		2.51 (N=2)		2.01 (N=2)		4.17 (N=2)		3.00 (N=3)		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Program Student Learning Outcomes (MS in Homeland Security Sciences -as defined in the Physics and Astronomy Department SACSSCOC Compliance Report and approved by the Office of Academic Affairs).

- Students will complete their masters theses and disseminate the results at professional meetings and/or in peer reviewed journals
    1. Department thesis committees will evaluate thesis progress, external presentations and thesis production
- Students will develop a mastery of several empirical methods.
    1. Students will demonstrate the successful use of critical laboratory skills required for empirical methods. The specific skills vary depending upon the focus of their thesis but for all students we begin with the empirical skills learned as undergraduates and develop and refine those skills so that the students will be successful in either an academic research setting or the workplace These skills are tested via performance on their thesis research. It is also tested through the preparation and dissemination of research results at conferences and through publications in peer-review journals. There were over 10 papers published with graduate students as co-authors during the review period. These skills are also evaluated through required research presentations in PHYS 598 (Graduate Seminar) and in the successful defense of the MS thesis.
- Students will show a mastery of foundational principles and requisite mathematics.
    1. The combined GRE and core course GPA will be in the top quartile.

A recent closing-the-loop example involves an increased program emphasis on students' ability to effectively communicate the results of their research activities. Through the required student presentations in PHYS 598 (Graduate Seminar) class, we detected deficiencies in the ability of our graduate students to demonstrate mastery of empirical methods through effective communication of

the results of their research work to an audience of students and faculty. Working with the thesis advisers and the student graduate committees, we have placed an increased emphasis on this skill during formal coursework, and also increased the number of presentation opportunities for students to sharpen their presentation skills. Although it is difficult to quantify this skill, we are confident, both through faculty evaluation of the presentations themselves, and by the more active dialog between the presenters and their student peers during Q&A sessions, that this skill set has substantially improved. Graduate students presented their research at regional and national conferences over 60 times and received 5 awards during the review period. The department is considering the development of a rubric to more quantitatively assess this critical skill, guided by a similar rubric used in certain upper-level undergraduate courses.

We note that for 2016-17 and 2017-18 the average time to degree is quite long. This is because in these years some students left the program for a period of time for a variety of reasons (personal, financial, , etc.). However, these students were subsequently encouraged and enabled to return and did complete their degrees.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The department tracks graduate school acceptance and post-degree employment status for the HSS graduates. The key areas of professional opportunity for students graduating from the program are either graduate school for further study (PhD) or employment in HSS related areas.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

We have no formal mechanism to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure that the curriculum is aligned with the necessary and/or desired employability skills. However, program faculty, through their research activities and memberships in related professional societies, are acutely aware of changing trends and directions in the area of HSS and provide direction and guidance to the graduate program director to keep the curriculum aligned accordingly. An example of using such information to improve the program was a recognition of the importance of, and growth in, the area of cybersecurity. This resulted in an increased emphasis in cyber defense in the program through the creation of the Cyber Defense Lab. While this was a short-lived initiative, the lessons learned will be applied to our new initiatives into the area of cybersecurity (see section 6a).

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

100% of our program graduates over the review period are either continuing their education at the graduate level (i.e., PhD programs) or have found employment in STEM positions.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					11	12
Number of NTE Faculty					4	4
Cost per SCH-Dept					158	128
Cost per SCH-program					1652	
SCHP/FTF by Dept.	410	361	375	368	372	375
% SCH by FTF by Dept.	91.8	87.6	87.7	88.3	92.0	75.8
Median Class Size by Level	4	2	5	2	3	8
% Under-Enrolled Sections by Level	100	100	100	100	100	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Department faculty generated between $50K and $350K per year in grant funding over the course of the evaluation period; much of this funding came from peer-reviewed proposals at the Federal level (e.g., NASA, NSF). All of the students in the HSS MS program received funding from, and were advised by faculty who were Principal Investigators on, these external awards.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Since the inception of the program, there has been no net growth in the number of Physics faculty. The increased teaching needs that resulted from the program have been met via a very cost- and tuition-effective shift in teaching responsibilities, in which GTAs in the program teach some undergraduate (PHYS 255 and 256) laboratories that would otherwise have been taught by faculty, thus allowing those faculty to teach courses in the graduate program. As a result, the program is effectively taught by experienced faculty, at a cost roughly equal to that of the graduate assistantships.

In order to properly take into consideration the presence of two former administrators on the faculty, we have calculated the cost/SCH using the median, rather than the mean, department salary. For the reviewers, the cost/SCH for the department is $186 using mean salaries and the cost per SCH for this program would be $2003 using mean salaries.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The MS in Homeland Security Sciences directly addresses the following elements of WKU' strategic plan:

Our Hill:

A culture of Innovation Review current teaching methodologies, integrate appropriate best practices, support the requisite physical structures and technologies, provide ongoing training for faculty in pedagogy, and include evaluation of instruction in tenure and promotion reviews.

Facilitate high impact practices, immersive learning in different cultures, process-learning practices, and collaborative learning and instructional opportunities.

The above aspects of WKU's strategic plan are addressed by program faculty who remain abreast of, hold leadership roles in the development of, and implement current research-based teaching methodologies and high impact practices in the program courses.

Our community and beyond:

A regional Lighthouse Ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others.

The above aspect of the strategic plan is addressed through program coursework which stresses critical thinking and problem solving throughout and as part of the research based thesis which each student is required to produce.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The MS in Homeland Security Sciences aligns with the statewide postsecondary education strategic implementation plan "Stronger by Degrees," by addressing strategies within policy objectives 6, 7, and 8 within the focus areas of Research, Economic, & Efficiency and Innovation. The MS in Homeland Security Sciences is an interdisciplinary program, bringing together faculty in Physics, Chemistry, and Environmental Health to mentor graduate student thesis projects, thus addressing strategic objectives 6.2 and 6.5. The inclusion in the program of coursework leading to a graduate certificate in Homeland Security from EKU addresses strategic objectives 7.2 and 8.1.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

According to "Careers in Homeland Security: Many Jobs, One Mission," a report from the Bureau of Labor Statistics, Emergency Management Specialist and Infrastructure Protection Specialist are two of the fastest growing career opportunities for HSS graduates. The WKU HSS program provides students with the specific skills necessary to provide vital contributions to modern society by evaluating, treating,

and adopting mitigation strategies in areas such as chemical spills, nuclear incidents, biological hazards and threats.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The MS in Homeland Security Sciences is unique in Kentucky; there is no other HSS MS program at any institution of higher education in the Commonwealth. A complementary program exists at Eastern Kentucky University; however its focus in on homeland security policy whereas the WKU program is focused on the application of scientific methods to issues in homeland security.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The WKU masters program in Homeland Security Sciences fulfills a unique need. It arose out of a clear need for individuals with the advanced scientific and technological knowledge and skills necessary to effectively provide our communities with effective evaluation of, and mitigation against, a growing number of very real issues that threaten the very fabric of our society. To accomplish this goal, this carefully-constructed program effectively couples knowledge from several different disciplines in order to provide graduates with the knowledge and skills necessary to make truly meaningful contributions to this growing and rapidly-evolving field.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We see two potential new areas of growth for the program. First, beginning in the spring semester we will work with the School of Engineering & Applied Sciences to incorporate elements of the computer science and CIT programs in order to create a cyber security track within the HSS program. Second, we will partner more closely with WKU's EHS program to incorporate curricular elements directly related to emergency management.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

IPEDs shows a continued growth in HSS degrees. However, the majority of the growth reflected in IPEDS is in policy-related, rather than in science-related, areas. There is an ever-growing need for individuals with the scientific knowledge and technical expertise to apply scientific solutions to problems and to policy direction in the field of homeland security.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The relatively low numbers of students in the program, and the more pressing needs for the scarce teaching resources available across Ogden College, have made it a challenge to offer the interdisciplinary courses needed to form the program. As result, we have developed more interdisciplinary content in certain physics courses in order to ensure students can not only meet degree requirements, but also gain the knowledge and skills that the degree signifies. We continue to be very flexible in allowing students to select appropriate elective courses, with the broad scope of the degree program's learning objectives in mind, and we particularly encourage students to select courses that are most relevant to their MS thesis topics.

We plan to be more aggressive in promoting and marketing the program, both within the state of Kentucky as well as regionally and nationally. We will be overhauling our program brochure and web pages in the spring semester and, in coordination with employers and other universities, developing a cohesive strategy to advertise the program to a wider audience.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

We envision a program whose enrollment is routinely 15 students within the next five years, and 25 -30 within the ten years thereafter. In order to achieve this goal, we will more aggressively market the program. Thesis-based STEM graduate programs are rarely completed in a part time basis, during which students work elsewhere. Rather, they thrive only when the students are fully supported as GTAs and/or GRAs so they can devote 100% of their time and energy to the program. We therefore intend to request modest additional resources to increase the number of program GTAs by 2-5, thus leveraging

(as we have done to date) this relatively small cost into substantial increases in both teaching and research effectiveness. Finally, particularly in light of the new RAMP budget model at WKU, we need to identify, and work to eliminate, issues resulting from the models for assignment of resources and faculty workload, both of which can limit the ability of HSS MS students to pursue interdisciplinary theses under the advisement of faculty from other departments.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Land Surveying
Reference Number:	1700
CIP Code:	400699
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	15
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Land Surveying Certificate (LSC) provides the student with the basic knowledge and skills needed to accomplish land surveying tasks for entry-level employment. These tasks include boundary surveys, topographic mapping, leveling, stakeouts, traversing, field note taking, distance and angle measurements, plus proper techniques and use of surveying equipment (total stations, EDMs, and levels).

The certificate is offered face to face.

Students receiving the Land Surveying Certificate must take the following classes:

- AMS 163
- CE 160 / 161
- CE 378 / 379
- CE 380 / 381

All classes are required or accepted as electives within the Civil Engineering program.

The land surveying certificate allows students to obtain professional licensure per KRS 322.045 (1)(c)(3) as a professional land surveyor.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	2	4	1	1	0	4
Conferrals	3	1	4	4	11	5
SCHP	17	38	58	57	123	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this certificate supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

Western Kentucky University is the only university in the State of Kentucky to offer the Land Surveying Certificate.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

CE students take CE 378/379 and CE 380/381 to obtain the Land Surveying Certificate. These courses also fulfill technical electives for the CE major. Due to staffing, only 16 to 18 students a year are able to enroll in CE 378/379 and CE 380/381. In the Spring of 2018 a new certificate coordinator was appointed after the retirement of the previous coordinator which resulted in a significant increase in conferral of certificates. Prior to Spring 2018, the proper paperwork was not being submitted for students to earn the certificate. Since that time, the number of students earning the certificate as continued to increase.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											NA
Progression	NA	NA	1	100	1	100	0	0	0	0	61.3%
150% Graduation Rate											NA
Time to Degree											NA

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The LSC is embedded in the civil engineering program and thus related to the same student learning outcomes (SLOs) as the civil engineering major. The program faculty developed the following student learning outcomes (SLOs) to prepare graduates to enter the professional practice of engineering:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The program uses a variety of rubrics and other tools to assess these SLO's in support of the ABET assessment plan. The program then uses the results from this assessment to create an action plan to improve the program.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

LSC have multiple opportunities upon graduation. The key areas of professional opportunity for students graduating from this program is in engineering roles in a variety of sectors which includes Structural, Geotechnical, Environmental, Transportation, Construction, and Water Resources Engineering. Additional careers in urban and community planning and civil site design. Most graduates are employed in the South Central Kentucky region after graduation.

To support graduate employment, a part time industrial liaison disseminates job and internship opportunities and assists students in development of professional skills such as resume writing and interviewing. Since the liaison began working at WKU in May 2017, she began surveying graduates last spring for post-graduation employment information. The key areas of professional opportunity for students graduating from this program is in engineering roles in a variety of sectors which includes structural, geotechnical, environmental, transportation, construction and water resources engineering. Additional careers in urban and community planning and civil site design.

Surveyors from this program are highly successfully in obtaining post graduate employment. The demand for surveyors is very high. According to the US Department of Labor, Bureau of Labor Statistics, the employment of surveyors is projected to grow 11 percent from 2016 to 2026, faster than the average for all occupations.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The LSC is part of the CE program and is assessed with ABET. As part of the ABET assessment plan, the program has a Civil Engineering Industrial Advisory Board composed of constituents of the program (alumni, employers of graduates, and faculty). The board usually meets bi-annually to provide feedback on the program activities and student success.

The Civil Engineering Industrial Advisory Board was consulted prior to purchasing new surveying equipment and software. They advised to purchase the equipment and software from a different vendor because the professionals on the advisory board and in the local industry use equipment from that particular vendor. This would allow our graduates to be more familiar with the equipment they would be using if they chose to work in the local industry.

In addition to providing feedback for the program, the Advisory Board has helped the ASCE (American Society of Civil Engineers) student chapter reach a broader range of engineering professionals to be guest speakers at chapter events and have helped provide opportunities for the students to get involved in the local community. This has helped emphasize what has been taught in the classroom and lead to job opportunities for new graduates.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The LSC allows our Civil Engineering students to obtain professional licensure per KRS 322.045 (1)(c)(3).

CE 378/379 and CE 380/381 support civil engineering and construction management students by providing a popular elective, and gives students the means to obtain professional licensure which is a desirable credential for many surveying and construction firms.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					NA*	12
Number of NTE Faculty					NA*	4
Cost per SCH					$35 *	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The civil engineering program has access to foundation accounts generated from philanthropic giving. Two faculty members in the program hold endowed professor positions within an average endowment of $40,000 over the past five years. A faculty member in the program holds an endowed chair position within an average endowment of $39,000 over the past five years. These endowed positions support faculty scholarship and student project engagement. There is a large civil engineering industrial base in the region that could be used for further philanthropic giving.

The foundation money available to the program is not intended to support the daily needs of the CE program or the Land Surveying Certificates. A program fee and course fees help with the sustaining of the program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

*Since all the courses required by the certificate are embedded in the civil engineering (CE) and construction management (CM) majors, there are no faculty dedicated to the certificate. The cost per SCH was determined by average the cost per SCH of CE and CM and then multiplying by the ratio of hours in the certificate compared to majors.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, those students who obtain the LSC are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, the LSC students learn to think critically and solve problems thus another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

A second aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." LSC students solve industry and community problems in the CE courses required to obtain the LSC.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8: Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *CE students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

According to the Kentucky Future Skills Report, the land surveyors and related fields have an estimated growth of approximately 15 percent across the state and approximately 4 percent growth in south central Kentucky in the next 5 years.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

WKU offers the only Land Surveying Certificate in the State of Kentucky. The professional engineering activities of the faculty create opportunities for the students to practice the art and science of contemporary Civil Engineering and surveying, in and out of the classroom.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

All engineering faculty at WKU are required to obtain and maintain a Professional Engineering license in Kentucky before tenure and first promotion, with anecdotal evidence that WKU is the only institution in the US with this requirement. The faculty believe this fosters a sense of preparation for professional practice in the students, helping them to be "*work-ready and fully*

prepared to pursue meaningful careers and lives." Additionally the adjunct instructors are also professionally licensed engineers and surveyors.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
Due to staffing a limited number of seats for each course are available each semester (between 16-18) for CE 378/379 and CE 380/381. Current course offerings are not enough to fulfill the requirement for Civil Engineering students that wish to pursue the LSC and several CE graduates are taking classes to complete their Land Surveying Certificate.
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
In the last year there was a need to replace the aging equipment used by the LSC. Several local and regional surveyors were consulted which resulted in replacing the equipment with the same equipment that local industry uses.
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
Currently, the School of Engineering and Applied Sciences cannot support any growth of the Land Surveying Certificate. Due to past growth within SEAS, the limited resources (personnel, space, and budget) are stretched to support the current student population and the courses we currently offer. To support future growth of the LSM, we would need additional lab space and additional faculty members. Adding faculty members to the Civil Engineering Program would strengthen the LSC certificate. In the next 5-10 years we would hope to be able offer enough seats in each CE 378/379 and CE 380/381 to fulfill the requirement for Civil Engineering students and allow students from additional majors outside of Civil Engineering to take each course to obtain the Land Surveying Minor.
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Lean Sigma
Reference Number:	0452
CIP Code:	
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	12
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The certificate covers concepts, principles, and skills related to six sigma, lean, theory of constraints, and total quality management. It is applicable for students and employees seeking professional Black/Green Belt or Lean certification. Industry offers substantial compensation to certified professionals. This holds true particularly for six sigma belts and lean certificate holders. Six sigma and lean principles have been applied successfully in business, engineering, health services, sciences, government, education, and media.

The certificate provides the knowledge and practical skills needed for successful completion of the American Society of Quality Six Sigma Green Belt or Black Belt Certification exams or the Society of Manufacturing Engineer's Lean Certification-Bronze level exam.

Courses taken in the certificate also count towards the Master of Science in Engineering Technology Management.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	1	7	10	12	6	4
Conferrals	0	3	0	6	1	5
SCHP	9	72	103	116	48	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

The Lean Six Sigma graduate certificate was developed as an embedded program with the master program of Engineering technology Management (MSETM). Students enrolled in the master's degree can also receive the certificate with no additional coursework required. Conversely, many students from other majors take the certificate to enhance their employment opportunities and promotion potential.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	0	0	0	0	1	100	1	100	0	0	73.7%
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Program Objectives

- Education and training for industry professionals or non-degree seeking students interested in obtaining six sigma or lean certification
- Attain known industry credentials with the option of applying credit hours towards completion of a master's degree
- Combine theory with practitioner skills and abilities for increased productivity and economic development
- Increased influence and promotion potential
- Opportunity for personal growth and learning

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

According to the 2015 Quality Progress Salary Survey, any level of Six Sigma training earns an additional $17,705. Having one certification adds $2,518 to the average annual salary.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The Lean Sigma graduate certificate was developed as an embedded program with the Engineering technology Management MS program (MSETM). The MSETM faculty is committed to continue to improve the quality of the program. MSETM has an active advisory board that meets regularly to give feedback to the program. The board recognized the value and need to continue to promote the lean Six Sigma graduate certificate as an online skills program for working professionals (Validated Oct 1, 2013). MSETM also is an ATMAE credited program and as part of the ATMAE assessment process, employers are surveyed each year regarding satisfaction with our graduates.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					0.61	12
Number of NTE Faculty					0	4
Cost per SCH					$185	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

This certificate is associated with the Masters of Science in Engineering Technology Management.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

This program supports several aspects of the WKU Strategic Plan:

- Our Community and Beyond, Continuing Education: Engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges
- Our Community and Beyond, Continuing Education: Ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others.
- Our Community and Beyond, Continuing Education: Offer quality graduate programs to further lifelong learning and retraining.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The program directly supports the following aspect of the statewide strategic agenda:

- Objective 10: Increase basic, applied, and translational research to create new knowledge, accelerate innovation, and promote economic growth.
  - 10.4. Increase opportunities for undergraduate students to conduct or assist in research.
  - 10.5. Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Over 200 manufacturing firms in the South-Central Kentucky region employ over 31,600 workers with a total payroll of nearly $450 million. It is the largest employment sector in the region (30%) and represents a broad range of diverse industries. While the vast majority of manufacturers in South Central Kentucky are small, employing fewer than 250, almost all workers earn benefits and higher-than-average wages. The region is projected to need over 9,000 workers by 2020 to fill critical middle-skill production and maintenance jobs, as well as management and engineering positions, due to impeding retirements and new job growth.

Industry offers substantial compensation to certified professionals. This holds true particularly for six sigma belts and lean certificate holders. Six sigma and lean principles have been applied successfully in business, engineering, health services, sciences, government, education, and media.

The Lean Six Sigma graduate certificate provides the knowledge and practical skills needed for successful completion of the American Society of Quality Six Sigma Green Belt or Black Belt Certification exams and the Society of Manufacturing Engineer's Lean Certification-Bronze level exam. Covers concepts, principles, and skills related to Six Sigma, Lean, Theory of Constraints and Total Quality Management. It is applicable for students and employees seeking professional Black/Green Belt or Lean Certification.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The certificate was first offered in 2012 for industrial professionals seeking Black/Green Belt Six Sigma or Lean certification. It continues to be popular with working professionals. The Lean Six Sigma graduate certificate was developed as an embedded program with the Engineering technology Management MS program (MSETM). Students enrolled in the master's degree can also receive the certificate with no additional coursework required. The Lean Six-Sigma Certificate curriculum opened additional opportunities for students and partnerships with industry.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

At present, there is not enough faculty capacity to offer the certificate within a reasonable amount of time. This has adversely affected the retention rate. Most students are non-traditional and want to complete the coursework in less than a year to begin receiving the financial benefits of their knowledge. We suggest converting the certificate to On-Demand and teaching the courses off-load so that faculty who are interested can support the certificate and students who want additional skills can take the coursework at an accelerated pace, if desired.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The certificate encompasses topics associated with industrial or manufacturing engineering at the master level. The desire of business and industry to operate efficiently has stimulated the demand for graduates who possess basic knowledge in three areas: lean, six sigma, and theory of constraints. As this certificate has graduate level content in engineering related skills, the national trends indicate increasing demand since 2000 (up 105%).

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The certificate was developed as an embedded program with the Engineering technology Management MS degree. Students enrolled in the master's degree can also receive the certificate with no additional coursework required. Conversely, many students from other majors take the certificate to enhance their employment opportunities and promotion potential.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Mention the word lean or six sigma to any business professional and they will instantly recognize the terms. The need for qualified individuals with these skill sets is easily determined with a brief conversation with any chief operations officer. The impediment is the lack of course availability in a timely fashion. Offering the course work using the On-Demand format would alleviate the constraint (Google the word "TOC") by supporting industry demand while releasing faculty to teach other needed curriculum in engineering, engineering management, and manufacturing engineering technology.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Manufacturing and Logistics
Reference Number:	1727
CIP Code:	150613
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Manufacturing Engineering Technology
Reference Number:	5006
CIP Code:	15.0613
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	Degree 120 / Major 58
List Concentrations (if any):	N

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Manufacturing Engineering Technology (MET) program is a combination of the former program Advanced Manufacturing (#506) and the new MET program. This program prepares individuals to apply basic engineering principles and advanced manufacturing technical skills in support of industrial operations. The major includes instruction in optimization theory, human factors, organizational behavior, industrial processes, industrial planning procedures, systems integration, quality, and project management. Graduates achieve positions of leadership in business and industry while practicing innovation in the global marketplace. Graduates obtain employment in a wide variety of positions. The teaching philosophy of this program focuses on project-based learning, which is achieved by engaging students through hands-on class projects, and also involving students with faculty applied research activities with industry. This program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The program is offered face-to-face with some online sections periodically. No minor, second major, or certificate is required.

MET students take the following supporting courses outside of the major in addition to Colonnade courses:

- AMS 163
- ACCT 200 or MKT 220 or FIN 161
- BUS 214C or COMM 345 or COMM 346 or COMM 349 or COMM 362 or MGT 361
- MGT 200 or MGT 310 or MGT 333

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	76	88	84	86	82	89
Conferrals	15	11	15	31	29	22
SCHP	978	1244	1234	1420	1411	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service"). This program offers service courses to the architectural sciences, construction management, and technology management programs.

The Technology Management (TM) and MET courses are taught by the same faculty and the programs both require many of the same classes (AMS271, AMS310, AMS342, AMS356, AMS371, AMS390, AMS394, and AMS430). In many of the courses, students from both majors are in class together.

TM and MET faculty also teach courses that support other majors in the college such as construction management and architectural science. Numerous students from computer science, as well as graphics communication, attend classes in CAD (computer aided design) as electives. TM and MET faculty also teach courses in the Master of Science in Engineering Technology Management (MSETM) program, which includes a JUMP option.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

MET faculty provide extensive teaching support to the construction management, architectural science, technology management, and MSETM programs. This results in less faculty productivity that is directed towards the MET program. The MET has several students who were part of the MSETM JUMP, but it is challenging to keep our students in graduate school as they are generally employed before they graduate.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	2	100	5	100	2	50	4	100	3	100	69.4%
Progression	NA	NA	79	67.1	76	68.4	75	78.9	62	68.1	61.3%
150% Graduation Rate	0	0	1	0	1	100	4	25	2	50	54.1%
Time to Degree **(Adv. Mfg & *MET*)**	4.14 (N=14)		6.52 (N=9)		4.69 (N=13)		4.48 (N=9) *4.32 (N=20)*		5.45 (N=3) *4.76 (N=25)*		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of the assessment plan in support of ATMAE accreditation.

The program faculty have developed the student learning outcomes (SLOs). At the time of graduation, the students should have attained the following SLOs:

1. Graduates will possess/ demonstrate the ability to identify, formulate strategies and solve technical problems.
2. Graduates will demonstrate an ability to communicate effectively in pertinent areas, both written and graphic,
3. Graduates will demonstrate the knowledge and capacity to apply managerial/ leadership principles and practices to appropriate situations.

The faculty have collected alumni feedback from the past five years:
Seventy-eight percent of respondents stated they agreed or strongly agreed they attained outcome #1 above.
Sixty-seven percent agreed or strongly agreed they attained outcome #2.
Eighty percent agreed or strongly agreed they attained outcome #3.

Since 2013, all graduating seniors have been required to take either the ATMAE Certified Manufacturing Specialist Exam or the Certified Technology Manager Exam, but are not required to pass it. Once the exam content is validated, the program can will use the exam scores to assess student skills compared to other ATMAE accredited programs.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Ninety percent of graduates had a job at the time of graduation with 10% hired within 2-6 months after graduation. All graduates state their first job was related or directly related to their major. First year average salary is $45K with graduates earning an average salary of $66K in five years.

The program requires that each student complete an internship or cooperative education experience with a local company. Internship survey forms are sent to the immediate supervisor. Employers are asked to rate the student's performance on 27 job-related skills on a Likert scale of 1-4, with 4 being outstanding. Over a six-year period (2011-2017), 50 employers rated graduates 3.4 on average.

The technical/managerial job titles reported by students graduating from this program are:

- Process Engineer
- Production Engineer
- Production Supervisor
- Manufacturing Engineer
- Field Engineer
- Production Group Lead
- Industrial Engineer

- Manufacturing Engineer
- Production Control Manager
- Quality Engineer
- Quality Assurance Manager

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ATMAE assessment process, employers are surveyed each year regarding satisfaction with our graduates. The program also has an active advisory board that meets regularly to give feedback to the program.

The MET Industry Advisory Board suggested combining the supply chain and lean systems courses in the MET curriculum and removing the food production course since it is not congruent with the Society of Manufacturing (SME) Four Pillars of Manufacturing Model. These curricular revisions were made effective Fall 2018.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3.3	12
Number of NTE Faculty					1.5	4
Cost per SCH					$61	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to a small foundation account that is shared by five programs. The average value over the past five years is $4,662.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. Course fees help with the sustaining of the program.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the MET program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the program, MET students learn to think critically and solve problems; thus, another aspect of the plan is supported ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded, including a required capstone course or study abroad opportunity.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves industry and community problems in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 7.2: Increase 2-year to 4-year transfer by providing more degree pathways, completer (2+2) programs, and transfer advising. *A memorandum of understanding has been signed with SKYCTC so that students who complete a 2 year degree can earn an MET/TM degree with 2 additional years.*
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *MET students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Over 200 manufacturing firms in the South-Central Kentucky region employ over 31,600 workers with a total payroll of nearly $450 million. It is the largest employment sector in the region (30%) and represents a broad range of diverse industries. While the vast majority of manufacturers in South Central Kentucky are small, employing fewer than 250, almost all workers earn benefits and higher-than-average wages. The region is projected to need over 9,000 workers by 2020 to fill critical middle-skill production and maintenance jobs, as well as management and engineering positions, due to impeding retirements and new job growth. (An Urgent Call to Action in Support of Manufacturing South Central Kentucky/Barren River Region, June 2013).

Market demand research by the Education Advisory Board (2014) found over 2000 online job postings for bachelor's-level manufacturing employees in Kentucky. Twenty-four percent were in the Greater Louisville area.

MET graduates gain entry-level positions as managers, engineers, designers, and technical staff with engineering and manufacturing firms. Promotion opportunities include the positions of Chief Operating Officer, Plant Manager, and Engineering Manager in manufacturing-related and technical services organizations. 11% of people in Kentucky are employed in manufacturing industries, which is a growth area according to the Kentucky Future Skills Report.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The function of the Mitch McConnell Automation Systems Laboratory is to mainly support the courses in the MET program. This lab is one of the few teaching laboratories in the U.S. to have computer numerical control (CNC) machine tools, robotics, and an automated computer-integrated-manufacturing (CIM) cell equipped with vision systems, laser technology, and programmable logic control. The lab is capable of providing students across the School of Engineering and Applied Sciences (SEAS) with automated tools for design, prototyping, and advanced manufacturing. This lab, along with three others provide hands-on, project-based learning for undergraduate and graduate students, research capabilities for faculty, and industrial resources for small business. In addition, Road Scholar Adventure educational tours from Boston (a non-profit organization in life-long learning) feature the labs as part of their national tour package.

The MET program is offered face-to-face, online, and as a competency-based education (CBE) On-Demand program. It is the **ONLY** CBE program at WKU and the **ONLY** online CBE manufacturing engineering technology program in the nation.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The SEAS Employment website currently lists 30 unfilled openings for manufacturing engineers, manufacturing managers, designers, and manufacturing project leaders.

All MET students are required to complete an internship as part of their graduation requirements. The majority of students easily find internships that pay $15-$20 per hour, except for the international students, who may need some assistance in finding local business.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

An opportunity for the MET program is better recruitment and placement of students directly from high school. Post-secondary school counselors and WKU admissions personnel have traditionally guided technically-oriented students into the Mechanical Engineering Pre-Major rather than advising towards programs that were located in the former AMS department. This should improve over time with the formation of the School of Engineering and Applied Sciences.

Approximately one-third of the students transfer to MET from Mechanical Engineering Prep (#543P). Opportunities for program marketing to recruit these students earlier before they lose one to two years attempting to meet Mechanical Engineering pre-major requirements would enhance WKU graduate rates and potentially increase retention. In addition, the program includes a managerial component in production operations that could be developed. Further interdisciplinary coordination within SEAS is needed to develop the former and more cooperation with the College of Business for the latter.

The program sees opportunities for collaboration with other WKU disciplines such as world language and entrepreneurship to create concentrations or tracks within the program.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The manufacturing sector's robust job situation is exacerbating the industry's pre-existing skills-gap challenge, which is rapidly evolving into a full-blown workforce crisis. The National Association of Manufacturers (NAM) Outlook Survey for 3rd Qtr. 2018 found that 73.2 percent of manufacturers stated an inability to attract and retain workers is their top concern. The survey also found nearly half of manufacturers (45.4 percent) cited this crisis as the number one threat facing their business. More than one in four (28.4 percent) said that it has forced them to turn down new business opportunities, and one-third (33.2 percent) noted that they have postponed plans to hire more workers due to workforce constraints.

Nationally, the number of bachelor's degrees conferred in the fields of engineering and engineering technologies increased 12 percent between 2004–05 and 2009–10, and then increased a further 30 percent between 2009–10 and 2014–15. For academic year 2015-16, engineering and engineering related degrees accounted for 6 percent (107,000 degrees) of the total baccalaureate degrees awarded.

MET program enrollment is steady at over 80 students for the last five years, but overall program growth has exceeded 600% since 2008. The placement rates of the program graduates are 100%.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

MET program faculty not only teach the MET curriculum, but also teach courses required for Construction Management (#533), Architectural Science (#518), Technology Management (#575), and the graduate program in Engineering Technology Management (#0447). Thus, the actual full-time equivalent faculty is less for this program and more for others. In addition, MET faculty support thesis production without release time or additional compensation. The program has always maintained a seat limit of 20 students for safety in laboratory classes. However, in fall 2015, the department (AMS) increased the number of seats for lecture classes to accommodate growth across multiple programs. This change disproportionally affected MET faculty as they taught most of the affected classes. All required courses in the MET curriculum are offered each year, except for three courses. Program concentrations were eliminated in F2013 and two courses were removed from the required curriculum in F2019. No program elective courses have been offered since 2008.

The primary limiter of program growth has been faculty capacity.

In 2016, the program name changed from Advanced Manufacturing to Manufacturing Engineering Technology based on feedback from our local industrial advisory board and our accrediting body (ATMAE).

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Five Years: Development of a Manufacturing Engineering (CIP code 14.3601) or Industrial Engineering degree (CIP code 14.3501) to replace, or in addition to, the Manufacturing Engineering Technology degree. As over one-third of our graduates already meet the math requirements (Math 136: Calculus 1), this would have minimal impact on existing students while enhancing the engineering profile of SEAS. Existing SEAS faculty are qualified to teach at this level until additional faculty could be hired.

Ten Years: Enhanced laboratory and faculty research capabilities to support local industries and secure contracts for services. This would be possible only with increased faculty capacity to develop equipment grants, build ongoing industry relationships and recruit graduate students.

Impediments (five years): Conversion of transitional faculty and instructors to tenure-track lines. Program enhancements cannot take place without full time faculty.

Impediments (ten years): The MS Engineering Technology Management graduate program has no dedicated faculty to teach the classes. All graduate faculty support are presently taken from faculty who also teach undergraduate courses. Because the program has a 100% job placement rate, getting students to stay for graduate school is a challenge.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Manufacturing Processing and Technology
Reference Number:	1728
CIP Code:	150613
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Chemistry
College:	Ogden

Program Name:	Master of Science in Chemistry
Reference Number:	059
CIP Code:	400501
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	General Thesis, Research Intensive Thesis, Biochemistry Thesis

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The MS degree in chemistry is awarded by completing the requirements in either the general or research-intensive tracks. Both tracks require laboratory-based thesis research, writing courses, and seminars. In addition, the general thesis track requires six lecture courses, while the research-intensive track requires two peer-reviewed publications and two lecture courses. Our admission requirements are: GRE ≥280, GPA ≥3.0, and a chemistry-related BS degree.

Graduate students are supported through either a research or teaching assistantship. Graduate student teaching assistants (GTAs) are crucial for supporting our undergraduate laboratory teaching mission. Many laboratory sessions are conducted with GTAs as the lead instructor. These students also play an active role furthering our faculty's applied research endeavors. Under the mentorship of our faculty, undergraduate and graduate students work together in the research laboratory and in the field. This work results in students presenting their findings at national scientific meetings and in publishing peer-reviewed publications as co-authors with their faculty mentors.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	30	26	30	29	23	19
Conferrals	22	12	10	17	9	6
SCHP	503	403	382	407	343	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

As part of the University, College and Department mission statements, all graduate students are active in research, which is a requirement of this MS degree. This program is a contributor to the economy of Kentucky by providing well-trained chemists that are needed in academia, government and industry positions. GTAs play a vital part of the undergraduate learning experience by instructing laboratory sessions that are in some courses part of the Collonade options. Graduate courses offered through this program are necessary for the completion of JUMP requirements. We maintain a very diverse graduate student body, with approximately half of these students being international.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Faculty mentors of these graduate students have a proven track record of obtaining external grants, publishing in peer-reviewed literature (with student coauthors), and scientific presentations. Findings gathered through the research efforts of these graduate students are vital for obtaining very competitive external funds. Over $5.5 million in external grants in the past 5 years have been awarded to faculty that are active in this graduate program. These grants include stipends to support graduate students in the research laboratory and funds to present findings at scientific meetings.

The Chemistry Department was among the first to have a JUMP, and it has grown to consistently have 2 to 3 students per class generation and has graduated five JUMP students over the last two years.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	10	90.0	12	100.0	8	87.5	4	75.0	9	88.9	82.2
Progression											
150% Graduation Rate	13	69.2	10	90.0	12	91.7	8	87.5	4	50.0	73.3
Time to Degree	1.85		1.70		1.84		1.67		1.91		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

We have set a goal that 80% of full-time students will complete an independent and original research project in two years. Our program over the past five years, had annual success rate that ranged from 75 – 100%. Our average completion rate is ~70%. All full-time students are required to complete an independent and original research project within three years. In the academic year of 2017-18, 13 students completed their M.S. degree, approximately 40% of our total number of graduate students. We do have several part-time students who are taking longer than two years, because they are currently employed full-time. Graduate students typically are required to present the results of their research at local, regional or national scientific and more than 70% of our total number of graduate students presented research at a local, national or regional meetings.

During their study, graduate students will be engaged in tasks that will evaluated by more than one faculty member. These tasks include defending their research proposal and thesis, completing a literature review paper, and publishing in peer-reviewed journals.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Graduate faculty actively engage in fruitful discussions with professors from outside Universities as part of our invited WKU seminar series. Our faculty receive feedback on making our students competitive for spots in Ph.D. programs. In the past three years 11 of our MS graduates have gone on to Ph.D. programs and 15 have gained employment in chemistry-related positions.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Visitors from industry and academic institutions regularly give presentations in the Department's seminar series. Students and faculty meet with these speakers to discuss a variety of topics, which often include educational and career opportunities (i.e., recruitment). These interactions provide valuable feedback that informs and enriches the academic experience of the program's students and faculty. Students and faculty also attend professional meetings to stay informed on recent advancements in chemical science

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Our department routinely receives chemistry job opening emails from employers across the state. These employers currently have our MS graduates working for them. These employers appreciate the strong background in critical thinking these students developed during their time in our MS program.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					2.32 (of 15)	12
Number of NTE Faculty					0.25 (of 4)	4
Cost per SCH					$486 ($101)	$128
SCHP/FTF by Dept.	495	548	578	618	518	375
% SCH by FTF by Dept.	96.4	98.0	95.4	92.9	86.7	75.8
Median Class Size by Level	7	4	6	6	4	8
% Under-Enrolled Sections by Level	73.3	85.7	76.9	60.0	87.5	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Our graduate faculty have a consistent record of securing highly competitive external funding. Over the past 5 years over $5.5 million was awarded to faculty that engage graduate students as a part of these awards. Graduate students are supported as research assistants with funds from these awards and in some cases tuition is covered. Our thermal analysis lab is self-supported through Kentucky industry contacts and fees for service. Graduate students are a part of this revenue stream and funds acquired are sometimes used for graduate student stipends.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Our Students

Goal 1: MS students accepted to our program are offered paid teaching or research assistantships, thereby making their time in this program more affordable.

Goal 2: We are a diversified student body (~40% international).

- Strategy 4: We work very closely with IEM/ISO recruiting international applicants.

Goal 5: We prepare students for a career in sciences through hands-on thesis based research.

- Strategy 12: Our thesis/committee structure engages students in professional development. Common intellectual experiences include (coursework) and high impact practices (publications, thesis, meeting presentations).

Our Hill

Goal 4: A MS student's tenure in this program revolves around research activities.

- Strategy 14: Most all students in this program present their results at national scientific conferences. Peer-reviewed publications are common, and both of these research dissemination routes strengthening the reputation and grant competitiveness of our department and WKU.
- Strategy 16: Externally funded grants often include the acquisition of expensive high precision chemical instrumentation.

Our Community and Beyond

Goal 1: Research accomplishments, based upon the efforts of our MS students, gain for our University national recognition.

- Strategy 1: Our program serves as a means to use scientific principles to solve problems in innovative ways.
- Strategy 2: MS students engage directly with undergraduates in laboratory research thereby benefiting a wider audience.
- Strategy 4: Theses and publications require the use of gained critical thinking and problem-solving skills. Public speaking skills are also developed through this graduate program.

Goal 2: Please refer to "Our Students Goal 2" above

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Our program directly addresses the following state objectives:

Objective 1: Improve diversity: We work very closely with IEM/ISO recruiting international applicants. About 40% of our current students are international.

Objective 10: Our graduate faculty are routinely awarded external research grants. Funding from these awards allows for the creation of new knowledge and innovation through graduate student research efforts. Some of our graduate students are supported working on projects that directly address solving scientifically based problems at industries in Kentucky, thereby promoting economic growth.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

Our well-trained graduates fill workforce needs in Kentucky that require very specialized skills. Our graduates enter into these positions that include: public school science teachers, chemical analysts, and quality control scientists.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The uniqueness in our program is highlighted in our student learning approach. Faculty mentors work closely with each graduate student to train and foster critical thinking skills through their thesis research project. Graduate faculty directly impact the national reputation of our program and WKU through the recognition of external grants and peer-reviewed publications.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

Our department has a high research productivity standard. External grants and high impact peer-reviewed publications are expected from our faculty. MS students are invaluable in this expectation. They provide laboratory work and ideas that foster innovation.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We envision our program to be more aligned with fostering economic growth for Kentucky. One goal of our graduate program is to seek research collaborations with industries in Kentucky. These collaborative research efforts will use our MS thesis students to help with the problem solving needs of Kentucky industries.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The national trends in graduate students have seen a decrease in international applicants. In the past three years our program has had most applicants being international.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

MS students are now required to present their research seminar during their 3rd semester. Previously this was done during students last semester. A 3rd-semester seminar will give students time to collect a body of data that can be presented to the chemistry faculty for critiquing. The student will have enough time (a semester) to work on additional recommended experiments.

A representative form WKU's ISO and the chemistry graduate coordinator went on a recruiting trip to India in Feb 2018. We were able to fill our TA spots from this trip and this effort has led to a number of students that continue to apply to our program. We expect these students to be productive members of our faculty research groups.

We have instituted a comprehensive examination of our program. The result was dropping an unpopular concentration (Coal chemistry) and revising our current tracks to include two writing courses (research proposal and literature review) and a more straightforward lecture course selection process.

As a result of reviewing class enrollment data in this comprehensive review process, we will also be adjusting the frequency of offering in most of our 500-level courses

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Ideally, we wish to grow the enrollment to a steady level of 30 students. To accomplish this we need to have additional funding to support 4 to 6 more GTAs per year and to increase the support level from $14k per academic year to $20k per academic year. This will help us provide our increasing number of research-active faculty with students that will commit to 2 years working on a research project. These students will also be available as instructors for our many sections of chemistry teaching laboratories. The increased support level will also attract a higher caliber of applicant an allow us to raise our standards for admission.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Master of Science in Mathematics
Reference Number:	049
CIP Code:	270101
Degree Type (AB, BS, etc.):	MA
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

This is our MA program for mathematics teachers that want to complete a Masters in their discipline that is both accessible after their workday has ended and is focused on the pedagogical aspects of the content. It is offered completely online.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	32	33	26	30	26	19
Conferrals	6	11	8	10	12	6
SCHP	253	186	162	201	148	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The 049 program requires a minimum of 12 hours of courses from the College of Education. The courses that we teach for this program are also required (12 hours) for students completing a Masters of Teaching with a focus on mathematics.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Enrollment is down slightly, as the state requirement that teachers complete a Masters in their first five years of teaching has been removed. There are also less expensive choices for completion of a Masters, which does not have to be in the discipline in which teachers are teaching and still earns them a pay raise in most public school districts. We have no control over tuition, but we have started a series of Google advertisements to try to recruit new students into the program.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	5	100	2	100	2	100	1	100	2	100	82.2%
Progression											
150% Graduation Rate	5	60	5	40	2	50	2	100	1	100	73.3
Time to Degree	2.33		2.92		2.89		3.86		2.42		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Outcome 1: Students will be able to communicate mathematics in a written form at a level commensurate with that of students completing a master's degree.

Means of Assessment: Paper/project from MATH 501, Introduction to Probability and Statistics I.
Criterion for Success: A score of 8 or higher on a 10-point multipart rubric will demonstrate students' ability to communicate mathematically.

Outcome 2: Students will be able to write proofs of theorems in mathematics.

Means of Assessment: Assessments from MATH 503, Introduction to Analysis (Math 512)
Criterion for Success: A score of 8 or higher on a 10-point multipart rubric for problems given on assessments will indicate that students are able to use multiple strategies in problem solving situations.

Outcome 3: Students will demonstrate their capacity to use multiple strategies and appropriate technology to apply mathematics in problem solving situations and will justify their solutions with sound logic.

Means of Assessment: Assessments from MATH 512, Geometry from an Advanced Perspective.
Criterion for Success: A score of 8 or higher on a 10-point multipart rubric will demonstrate students' ability to choose appropriate strategies, including the use of technology, to solve problems and justify their solutions.

Outcome 4: Students will demonstrate their capacity for collaboration in the mathematics classroom as a learner and as a teacher.

Means of Assessment: Discussion boards from MATH 511, Algebra from an Advanced Perspective.
Criterion for Success: A score of 8 or higher on a 10-point multipart rubric will demonstrate students' ability to collaborate when working towards solutions to problems.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

This is a masters program where the students almost always are employed. The goal is not to gain employment, but it provides a higher rank and a pay raise.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

To meet the demand of more high school students taking dual credit courses, teachers are referred to us by school systems to pursue a master's degree to teach dual credit courses and/or teach at a community college.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Our time to completion is a bit higher than in some programs, but the large majority of students in the 049 MA program are taking classes part-time while they working as middle-grades and secondary mathematics teachers. Given that fact, students progress through the program quite efficiently.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	10	6	8	6	8	8
% Under-Enrolled Sections by Level	50	58.3	69.2	62.5	66.7	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Because the 049 MA program is offered completely online, the courses do earn extra DELO revenue.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Within the past three years, additional full-time faculty were hired to meet the demands of the students, program and department.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Our 049 MA graduate faculty are committed to the completion and success (p. 7) of all students in the program, and are proud of their role in providing continuing education (p. 15) to teachers wishing to develop knowledge in their discipline.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The high and timely completion rate of the students in the 049 program addresses Objective 6. Our highly effective graduate faculty, one of which has won the college teaching award, address Objective 8. The research productivity of those faculty addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Future Skills Report seems to be heavily focused on engineering, manufacturing, and health-care related jobs. Nearly all of our MA students are teachers. So, please remember that, while engineers make bridges and cool gadgets and doctors make people better, teachers make engineers and doctors.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The program is one of very few programs that are discipline-specific (not an MAE) that is offered online. (Only one in the state?)

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The existence of an MA program in our department has enabled us to attract and retain an extremely high quality of tenure-track math education faculty over the past decade. These teachers would not have even applied to work at WKU if we did not have a Masters program. I do not see that reality addressed anywhere else in this "comprehensive assessment".

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
Program faculty already communicate well with the School of Teacher Education faculty and administration, since we each teach courses that the other's programs require. We are hopeful that our new Google ad campaign will lead to increased enrollments.
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
There has been an increase in the number of masters degrees awarded in math nationally over the last 10 years.
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
We have implemented a new recruiting and marketing plan, added new faculty members, and revised some courses to meet the needs of those people wanting to teach at a community college and that helped with recruiting.
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
Over the next 5 – 10 years, we hope to increase enrollment due to recruiting and marketing plan, while increasing the number of students who successfully complete the program. We will also reevaluate the needs based on recent changes in requirements of the state.
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Master of Science in Mathematics
Reference Number:	085
CIP Code:	270101
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	30
List Concentrations (if any):	General, Computational, and Economic

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The MS program is primarily for students either on their way to a Ph.D. program in mathematics, or looking for a mathematics teaching job at the university or community college level, or looking for employment in industry. It is very much a traditional program, with no online courses and almost every student on assistantship and writing a thesis with a faculty member's supervision. Nearly all students in the program have earned a bachelors degree in mathematics before starting the program, and a few students continue into the program from their bachelors at WKU (this includes a few JUMP program students). The general track is for students interested in basic mathematical theory (algebra, topology, etc.). The computational track is for students interested in more applied mathematics and computer-aided topics and the economics track is for students interested in mathematical economics. The computational and economic options are for students who may want to enter a Ph.D. program in applied or computational mathematics or directly enter business or industry.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	11	9	10	15	12	19
Conferrals	2	5	2	4	7	6
SCHP	168	126	141	222	155	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The general option of this program would likely not contribute to programs outside of our department, but we do have a number of students in our JUMP program that will major in 528 (extended major) and then move into an assistantship in the 085 program during the middle of their fourth year. We also have students in the 528 major that will take graduate courses in the 085 program for undergraduate credit. The computational and economics options require courses in computer science and economics, respectively.

Students in the MS program that are on graduate assistantship (nearly all of them) contribute greatly to our ability to offer the MATH 136 Calculus I and MATH 137 Calculus II courses, as they conduct the recitations on these courses, reducing the faculty workload from 4 hours to 3.25 hours in these courses. In Fall 2017, for example, we offered 10 sections of MATH 136 and 6 sections of MATH 137, so our assistants saved faculty 16 * 0.75 = 12 workload hours (at a bargain price), which is equivalent to the teaching load of one-and-a-third research-active faculty members.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The likelihood of a student completing the 085 MS program is much better in the last five years than in the years previous, due to us increasing the stipend offered to graduate assistants. This cut our number of assistantships roughly in half, but also enabled us to attract a much higher quality student to the program. Also, our number of enrolled students is fairly steady, as the size of the program is intimately tied to the number of assistantships available. All of the students graduating during the review timeframe completed a thesis.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	2	50	5	80	3	66.7	4	75	8	87.5	82.2%
Progression											
150% Graduation Rate	2	50	2	50	5	80	3	66.7	4	75	73.3
Time to Degree	1.67		1.67		1.84		1.78		1.89		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Outcome 1: Students should possess knowledge of a broad topic in mathematics commensurate with that of a Masters graduate.

Assessment: All students must take a minimum of 30 credit hours of graduate-level mathematics courses. The courses of the MS program give a broad and deep background in the given concentration.

Outcome 2: Students should be able to apply research methods to understand mathematical problems and possess the ability to apply technology and other tools to effectively investigate mathematical problems.

Assessment: Problem-solving skills are well monitored in all graduate-level mathematics classes. MS students are required to have a capstone project. This project is usually a thesis, but comprehensive exams are an option. The comprehensive exams are assessed by two graders and rigorously test students' problem-solving skills. Students write their theses using, among other possible software, the standard software used by the mathematical community (AMS-Latex).

Outcome 3: Students should be able to speak and write with mathematical maturity commensurate with that of a Masters graduate.

Assessment: Students' writing and speaking skills are assessed by their mentors, classes, and in Math 598: Graduate Seminar. Thesis students write a thesis and present an oral defense to a committee of 3 or more people, generally consisting of WKU graduate faculty. Students are encouraged to improve their communication and mathematical skills by regularly attending seminars and speaking in seminars. Students are encouraged to attend and present at conferences.

Closing the loop: The capstone project used to consist of both a thesis and comprehensive exams. None of WKU's benchmark institutions had both of these requirements for their MS programs. The capstone now consists of either a thesis or comprehensive exams, with strong encouragement for the thesis option. As a result, MS students focus on their theses, and they often lead to publishable results.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The core of the MS program is very traditional, and is consistent with the majority of core courses in Ph.D. programs around the country. We do follow, however, the success of our graduating MS students as to either graduate school acceptance or gainful employment due to their degree, and typically have 100% placement in one or the other. Of the 6 students graduating with their MS in 2017-18, 2 went on to assistantships in Ph.D. programs, 2 took teaching jobs at postsecondary institutions, and 2 took positions in government and industry.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The core curriculum is aligned with nearly every math Ph.D. program's core curriculum. The elective courses are comparable to courses found at Ph.D. granting institutions and are aligned to the research specialties of our faculty. The creation of the computational track was in response to the rising presence of such programs at other masters-granting institutions, and better reflected the nature of the applied courses several of students were electing to take. The mathematical economics track was created as a potential destination for graduates of the 731 Mathematical Economics bachelors program, which is a rapidly growing major, that want to focus on mathematical and statistical applications in economics.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The MS program in mathematics at WKU seems to prepare students very well for doctoral programs. Ph.D. programs typically have graduation rates around 50%. Out of the students that graduated with an MS from Fall 2008 to Spring 2013, 9 of 11 students entering a Ph.D. program have completed their doctorate, and 9 more MS students graduating after Spring 2013 have started a Ph.D. program. The department also regularly invites and hosts outside mathematicians, from companies and universities from the U.S. and other countries, to help our graduate students see various options for their future plans.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	10	6	8	6	8	8
% Under-Enrolled Sections by Level	50	58.3	69.2	62.5	66.7	58.2

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

MS faculty have brought in grant funding totaling $15,676 in 2015-16, $46,626 in 2016-17, and $122,832 in 2017-18. While these amounts may not sound large in comparison to disciplines that have heavy machinery and consumables requirements, note that research in mathematics does not typically have these requirements. Most of our grant funding went into summer pay for faculty and support for undergraduate students and students in the MS program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

It is again important to point out the dependency on the 085 MS program on the number of well-funded assistantships that we are able to offer. While we are running well above the university average for SCH/FTF, we could be doing even better if our assistantship funding (and ability to offer more assistantships) was going up instead of going down.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The 085 MS program hosts a diverse body of students (p. 6), with recent and current students from China, India, Bangladesh, Sri-Lanka, Vietnam, Turkey, Azerbaijan, Ghana, Uganda, and, of course, the U.S. The large majority of these students complete the program and go on to be successful (p. 7) in either getting an assistantship in a math Ph.D. program or getting a teaching job at the postsecondary level. Our 085 graduates are prepared for the global stage (p. 7), after contributing to the research and creative activities (p. 11) of the faculty member who supervised their thesis. In fact, we have had 20 joint publications in peer-reviewed journals with faculty and MS students in the last five years. Many of our graduate students have attended and given talks in national and regional conferences. We feel that the MS program has contributed to WKU's goal of global learning (p. 15), by effectively educating a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The diverse backgrounds of our MS students (mentioned above) and our graduate faculty (with 10 different countries of origin) address Objective 1. The high and timely completion rate of the students in the 085 program addresses Objective 6. Our highly effective graduate faculty, three of which have been named UDP's and one of which has won the university's research award, address Objective 8. The research and grant productivity of those faculty, often with the aid of students in the MS program, addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Future Skills Report seems to be heavily focused on engineering, manufacturing, and health-care related jobs. The largest proportion of our MS graduates will become teachers – either immediately or after completing their doctorate. So, please remember that, while engineers make bridges and cool gadgets and doctors make people better, teachers make engineers and doctors.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

Of the non-Ph.D. granting schools in Kentucky, we believe that we have the highest quality graduate faculty and graduate students in the state. Consider as a metric the number of publications in MathSciNet per number of tenure/tenure-track faculty when compared to other state regional comprehensives.

- WKU: 78 publications; 23 faculty as of Jan. 1st, 2018; ratio: 3.39
- EKU: 55 publications; 19 faculty; ratio: 2.89
- Murray State: 26 publications; 19 ratio: 1.37
- Morehead State: 11 publications; 10 faculty; ratio: 1.1
- NKU: 17 publications; 21 faculty; ratio: 0.81

Three of our graduate faculty have been recognized by the university as UDP's, one has received the university award for research, and one is respected enough in his field to have been able to host the international Summer Topology Conference last summer. (The last three were hosted by the University of Dayton, the University of Leicester, and the National University of Ireland, Galway.)

Nearly all of our graduates from the 085 program either get assistantships to Ph.D. programs or find employment at the postsecondary level. As previously mentioned, our MS faculty and students are marvelously diverse culturally, and the male/female ratio of our MS faculty is comparable to the national average at 26.3% female.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)
The existence of an MS program in our department has enabled us to attract and retain extremely high quality tenure-track faculty over the past decades (3 UDP's, 1 university research award winner, perennial "favorite teachers", several junior faculty that are thriving). These teachers provide instruction to many other majors in Ogden College (engineering, physics, etc.), and they would not have even applied to work at WKU if we did not have a Masters program. I do not see that reality addressed anywhere else in this assessment.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We could definitely grow the program if we had more assistantships, as we turn away qualified students applying for assistantships each year. We have now included a track for mathematical economics, as a destination for students completing our rapidly growing 731 mathematical economics major.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

There has been an increase in the number of Masters degrees awarded in math nationally over the last 10 years.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

We have recently included a track for mathematical economics, as a destination for students completing our rapidly growing 731 mathematical economics major. We have attempted to try to put graduate course offerings on a rotation, but this is complicated by the varying backgrounds of our incoming students.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Moderate growth is possible with increased funding that would allow more assistantships at their current amount. We would also expect a sizeable increase in quality of our assistantship candidates if the university would extend tuition waivers as a part of assistantship offers. (We could then theoretically scale back the size of our stipends a bit, and increase the number of assistantships we offer.)

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Mathematics/Economics
College:	Ogden/Gordon Ford

Program Name:	Mathematical Economics
Reference Number:	731
CIP Code:	450603
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	49 or 61, depending on concentration
List Concentrations (if any):	General and Actuarial

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

Mathematical Economics is a joint degree offered by Mathematics and Economics Departments. The program offers two concentrations:

- **General Concentration** gives students an opportunity to learn economics while gaining a solid foundation in mathematics. This concentration provides ideal preparation for the student interested in pursuing a graduate degree in economics or working as a data analyst. The concentration requires 49 hours and is ideally combined with a second major or a minor to complement this degree.

- **Actuarial Science Concentration** prepares students for careers as actuaries. Actuaries use a combination of strong analytical skills, business knowledge, and an understanding of human behavior to manage risk. To become an actuary, students pass a series of exams to earn actuarial designation by one of the actuarial societies. This major helps students prepare for these exams and allows them to receive Validation by Educational Experience (VEE) credit, a requirement for becoming an actuary. The major requires a minimum of 61 hours and does not require completion of a second major or a minor.

The program is taught face-to-face. Most students are traditional full-time students. To be admitted into the major, students must have 60 hours with the overall GPA of at least 2.0.

Mathematical Economics (Ref. #731)

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	23	31	39	43	58	89
Conferrals	1	1	6	11	12	22
SCHP (MATH+ECON)=Total	155+168=323	239+252=491	238+316=554	359+398=757	389+511=900	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The general track of the major involves coursework from both the Mathematics and Economics Departments, and actuarial track students also take coursework from the Accounting department, Finance department and the School of Engineering and Applied Sciences. This major is the only University major that is housed in two separate departments in two separate colleges (Ogden and Gordon Ford).

The students in this major can also progress to earn a MS in Mathematics (Mathematical Economics concentration) or MA in Economics (Mathematical Methods concentrations). Both masters' programs offer JUMP options, allowing students to start working on a master's while completing their undergraduate degree.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Enrollment has grown dramatically since the major's creation in Fall 2011. However, this is likely to the detriment of the enrollment in other math majors. (Before the major existed, students wishing to be actuaries, for example, would double major in the 728 math major and the 638 economics major.) Since it shares courses with the 528 and 728 majors in the Math Department, it makes more sense to look at those majors combined productivity in their departments, as the total enrollment and SCHP in the three majors is a more accurate measure of total productivity in the Math Department.

Mathematical Economics (Ref. #731)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	4	100	8	87.5	7	100	10	90	7	100	69.4%
Progression			25	84	22	86.4	39	84.6	39	92.3	61.3
150% Graduation Rate	0	0	0	0	0	0	0	0	4	75	54.1
Time to Degree			3.34		3.50		4.61		3.64		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Student learning outcomes:

1. Understand economic theories and institutions in both microeconomics and macroeconomics.
2. Set up and solve an economic problem using foundational mathematical/statistical tools.
3. Develop an economically intuitive explanation of a mathematical/statistical solution.
4. Understand how to use empirical evidence to evaluate the validity of an economic argument.
5. Communicate economic ideas and arguments in oral and written forms.

Means of assessment: Senior project completed in Math 498/ECON 497 with a grade B or better. ECON 497 students complete a research paper and present it at a poster session to the faculty. The project is a truly culminating experience as it pulls from the knowledge acquired in the major, uses the analytical skills obtained in the program, and teaches students how to effectively communicate complex ideas. The students are rated on content, organization, language and use of visual aids. MATH 498 similarly complete a project, with a culminating paper and presentation that are assessed by their supervising faculty member and two other faculty on their committee.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Because the program is relatively new, we have not yet had an opportunity to collect meaningful data on job market outcomes. Exit surveys, however, are given to all graduating seniors, and they indicate that students are confident about their job market prospects.

One of the metrics that can be collected in the future is the pass rate on the actuarial exams. These exams are administered by actuarial societies and will provide an objective measure of the level of preparedness of our students.

There is little data available on job market outcomes of similar majors in the state of Kentucky. Nationally, however, the Bureau of Labor Statistics (BLS) estimates there were 23,600 actuary jobs in 2016 and over the next decade that number is projected to grow by 22%, a much higher rate than in most industries. According to BLS, median annual pay for actuaries in 2017 was $101,560. The typical entry-level education in the field is a Bachelor's degree.

Mathematical Economics (Ref. #731)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

For the actuarial track, the percentage of students who have sufficient scores in actuary exams can be used as an indicator of how the curriculum is aligned with the necessary employability skills. For the students to be able to earn Validation by Educational Experience (VEE) credit, the Society of Actuaries (SOA) has to approve economics, mathematics, accounting, and finance courses that will be used for that credit. Thus, SOA provides us with direct feedback on whether our curriculum meets the industry demands, and ensures that both the general and the actuarial tracks offer the skills needed in the job market. Furthermore, curriculum for the actuarial tract was developed with the consultation of alumni who work as actuaries.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

As the data above indicates, this major attracts high-quality students. The retention rates are high, the progression rate is well above average and the time-to-degree in most years is well below the university average.

Mathematical Economics (Ref. #731)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR ECONOMICS	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					12	12
Number of NTE Faculty					0	4
Cost per SCH					$126.41	$128
SCHP/FTF by Dept.	626	692	625	687	647	375
% SCH by FTF by Dept.	80.1%	86.5%	75.4%	73.0%	73.1%	75.8
Median Class Size **(Upper Division)**	26	27	34	33	33	19
% Under-Enrolled Sections **((Upper Division)**	28.6%	12.9%	17.1%	17.1%	17.1%	36.3%
a. Data Provided by AA/IR MATHEMATICS	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**17/18 Univ. Median**
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					$120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Mathematics faculty teaching 731 coursework have brought in grant funding totaling $15,676 in 2015-16, $46,626 in 2016-17, and $122,832 in 2017-18. While these amounts may not sound large in comparison to disciplines that have heavy machinery and consumables requirements, remember that research in mathematics does not typically have these requirements, and that most of our funding went into summer pay for faculty, and support for undergraduate and graduate students.

Since 2011, the Economics department has brought in $242,600 of outside funding and have used these funds to bring nationally renowned speakers to campus and to support student research. These grants have also funded several students to attend and present their work at national research conferences.

The Center for Applied Economics has been actively engaged with local businesses, government and non-profits. The Center received funding from the Turner Family Foundation to study economic development opportunities in Allen county, as well as funding from Bowling Green Chamber of Commerce to conduct economic impact studies.

Mathematical Economics (Ref. #731)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)
The program was created using existing courses in economics and mathematics, combining them into one degree, so the additional cost of having this program is virtually zero. On the mathematics side, this program shares courses with 528 and 728 majors, so this program often increases enrollments in existing courses. On the economics side, the program shares courses with the Economics major (638), the Business Economics major (724), and the Economics minor (356). The only course that has to be offered on a regular basis to serve this program is Mathematical Economics (ECON 464), which is taught once a year.

Mathematical Economics (Ref. #731)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The 731 program hosts a diverse body of students (p. 6), with students from all over the world. A large number of these students complete the program and go on to be successful (p. 7) in getting into graduate programs with assistantships. Our 731 graduates are prepared for the global stage (p. 7) after completing their coursework, and many have contributed to the research and creative activities (p. 11) of faculty members who supervised their research. In fact, mathematics faculty had ten joint publications with undergraduate math majors in the last five years. Economics faculty co-authored three papers with undergraduate students that were presented at national conferences. We feel that the 731 program has contributed to WKU's goal of global learning (p. 15), by providing a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The diverse backgrounds of our 731 students (mentioned above) and faculty (with ten different countries of origin in the Mathematics department and four countries of origin in the Economics department) address Objective 1. The high and timely completion rate of the students in the 731 program addresses Objective 6. Highly effective faculty in both departments address Objective 8: In the Mathematics department three faculty have been named UDP's, one of whom has won the university's research award; The Economics department is also home to a UDP and multiple winners of the College of Business research awards. The research and grant productivity of those faculty, often with the aid of students in the 731 program, addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The *Kentucky Future Skills Report* provides limited information on the need for actuaries in the state of Kentucky. It also does not provide much information on the occupations of Mathematical Economics majors in general. As was stated above, the Bureau of Labor Statistics projects high demand and strong earning for actuaries. At the time of writing of this report, a search for "Actuary" on Linkedin jobs returned 10 positions in the state of Kentucky with companies such as Humana and Anthem. Expanding the search nationwide yields more than 2,500 job openings, so there is a strong demand for this degree.

Mathematical Economics majors who complete the general track will likely go on to graduate schools in economics or occupy positions similar to graduates of Business Economics (724). The top industries for that major are

- Finance and Insurance (11,962 projected job openings; $53,833 average wage)
- Professional, Scientific, and Technical Services (17,728 projected job openings, $60,321 average wage)
- Manufacturing (39,895 projected job openings, $44,099 average wage)

Therefore, there appear to be ample employment opportunities for the students in this major.

Mathematical Economics (Ref. #731)

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
This program is the only program on campus that is housed in two separate departments in two separate colleges (Ogden College and Gordon Ford College of Business). To our knowledge, the only other Mathematical Economics program in the state is at the University of Kentucky. Another unique feature of this program is its actuarial track – most universities in Kentucky that have actuarial science programs offer them through their mathematics departments. Because WKU's Mathematical Economics is a joint venture between the two departments, it gives students an opportunity to earn more VEE credits while completing their degrees. Additionally, because the actuarial track requires students to take finance and accounting courses, with just a few extra classes students can pick up another minor. This allows students to stack multiple credentials without significantly impacting the cost of the degree or the time to graduation.
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)
Western Kentucky University is the perfect home for the Bachelor of Science in Mathematical Economics program. It is close to Louisville and Nashville, large financial and insurance centers in the United States. This creates a ready and easily accessible market for our students. The close proximity of these markets makes it easy to maintain contact with prospective employers and to stay up-to-date on current changes in the industry which might affect the program.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The joint nature of the program is the perfect example of how interdisciplinary connections can greatly benefit our students. The program design already took advantage of the many trends in these disciplines by combining the technical side of math courses with the applied side of economics.

One potential growth area is in the recruitment of international students. Most international students who complete a degree in the United States are allowed to work for one year during what is called "Optional Practical Training". According to the Department of Homeland Security, graduates of the programs with CIP code 450603, which is the code of the BS in Mathematical Economics, qualify for a two-year extension of the OPT, allowing the international students to work for three years in the United States. This can be used as a major recruiting tool to attract high-quality international students.

As of right now, on the mathematics side, the efforts are focused in recruiting into math major in general, and then directing students to the correct version (528, 728, or 731) based on their career plans. A similar approach is followed on the economics side by recruiting students into one of the economics majors and then directing the students according to their interests.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The number of baccalaureate degrees in math and stats has risen slowly over the last five years, although the total WKU enrollment has gone down. Nationally, the share of economics majors among all majors has remained largely constant. Therefore the success of the Mathematical Economics major points to the fact that skills it offers are highly desirable in the job market. Evolution of technology in data science, machine learning, and artificial intelligence will continue to increase the demand for individuals with applied analytical skills.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

In recent years, the Mathematics department passed several proposals to offer more statistical courses to meet the need of students in the major.

The Economics department, through efficient allocation of resources, has been able to offer on a regular basis a Mathematical Economics course as well as a Forecasting course, both of which are required in the two concentrations of the Mathematical Economics. This enhanced students' progress toward degree.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

We have seen a significant growth in the number of students enrolled in the major. We would like to see the program continue at its current strength. In five years, the program will be fully established and improved to prepare our graduates necessary skills. In ten years, the program will expand and a well-established connection to insurance and financial companies nearby will be formed. Students will get sufficient training to ensure internship experiences and jobs during and after their study in the program. If the program continues to attract new majors at its current pace, a new faculty line would be instrumental to the program's continued success.

Mathematical Economics (Ref. #731)

e. What recommendation would you put forward for the program (check one)?	
☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE REASSESSMENT of ACADEMIC PROGRAMS
EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Mathematics
Reference Number:	021
CIP Code:	
Degree Type (AB, BS, etc.):	
STEM+H Degree (Y/N)	
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	0	0	1	1	1	4
Conferrals	0	0	0	0	1	5
SCHP	3	0	7	0	12	44

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											73.7
Progression			0	0	1	100	1	100	0	0	61.3
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Mathematics (no minor required)
Reference Number:	528
CIP Code:	270101
Degree Type (AB, BS, etc.):	AB
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	51
List Concentrations (if any):	Fundamentals of Analysis and Discrete Mathematics, Fundamentals of Applied Mathematics, and Fundamentals of Mathematical Studies

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

This program is primarily for students that wish to continue their mathematics education by going to graduate school for a masters or doctorate in mathematics, and does not require a minor. Students completing this major also are required to take two computer programming courses (CS 180 and either CS 221 or MATH/CS 371), and also a logic course (PHIL 215 or EE 180).

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	24	33	29	21	20	89
Conferrals	1	4	4	3	4	22
SCHP	215	326	295	256	228	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

A large number of the courses that are taken by our 528 majors are also taken by students from majors in other departments (engineering, physics, meteorology, etc.) and all courses are shared with the 728 and 731 majors. Students that participate in our JUMP program take this major, and then transition into the 085 MS program. It is not uncommon for 528 students to take graduate courses typically taken by 085 graduate students for undergraduate credit.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

This major will likely never have a large enrollment, as it satisfies a particular niche – students who have decided early in their college careers that they want to go to graduate school in mathematics. However, since it shares courses with the 728 and 731 majors, it makes more sense to look at their combined productivity, as the total enrollment and SCHP in the three majors is a more accurate measure of total productivity.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	4	50.0	7	71.4	11	90.9	5	80	5	80	69.4%
Progression			16	75	18	88.9	14	50	12	58.3	61.3
150% Graduation Rate	15	80	9	44.4	6	66.7	6	50	4	25	54.1
Time to Degree	4.90		5.71		3.48		4.24		5.59		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Outcome 1. Students will be prepared for employment in government, industry, or academic settings.

Assessment: Employment prospects of seniors will be monitored in an exit survey.

Assessment: Feedback from recent graduates will be monitored at the Career Options Panel at annual WKU Mathematics Symposium

Outcome 2. Students will be able to use technology and apply mathematics to solve problems effectively.

Assessment: Technology usage will be monitored in an exit survey.

Assessment: Problem solving will be monitored in all courses and in a required capstone project.

Outcome 3. Students will have well-developed abilities to utilize critical thinking and communicate ideas effectively.

Assessment: For each senior, a committee of three graders will review a 11-15 page paper and a 25-minute presentation on the student's capstone project.

Closing the loop: Due to demand from students and employers in recent years, the department has increased offerings in statistics.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Exit surveys are given to all graduating seniors. Placement of students in graduate schools is monitored on a more personal basis than a systematic basis, since the numbers are fairly small.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Each year at the WKU Mathematics Symposium, we have a Career Opportunities panel with about four panelists. The panelists discuss employment opportunities in their chosen path and indicate the courses and skills which are important to their career. Such feedback has led to increased offerings in statistics. In many instances, the preparation of our students is monitored by personal contacts between our faculty and faculty at Ph.D. programs where our students are placed.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The national demand for Ph.D. students in mathematics fluctuates cyclically. When the national demand is high, our students have good success; when it is low, our students may not be placed in their first choice for a Ph.D. program.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
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Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Mathematics faculty teaching 528 coursework have brought in grant funding totaling $15,676 in 2015-16, $46,626 in 2016-17, and $122,832 in 2017-18. While these amounts may not sound large in comparison to disciplines that have heavy machinery and consumables requirements, remember that research in mathematics does not typically have these requirements, and that most of our funding went into summer pay for faculty, and support for undergraduate and graduate students.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

This program shares courses with 728 and 731, so this program often increases enrollments in existing courses.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The 528 program hosts a diverse body of students (p. 6), with students from all over the world. The large majority of these students complete the program and go on to be successful (p. 7) in getting into a graduate program with an assistantship. Our 085 graduates are prepared for the global stage (p. 7) after completing their coursework, and many have contributed to the research and creative activities (p. 11) of a faculty member who supervised their research. In fact, we have had 10 joint publications with faculty and undergraduate math majors in the last five years. We feel that the 528 program has contributed to WKU's goal of global learning (p. 15), by providing a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The diverse backgrounds of our 528 students (mentioned above) and our graduate faculty (with 10 different countries of origin) address Objective 1. The high and timely completion rate of the students in the 528 program addresses Objective 6. Our highly effective graduate faculty, three of which have been named UDP's and one of which has won the university's research award, address Objective 8. The research and grant productivity of those faculty, often with the aid of students in the 528 program, addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Future Skills Report seems to be heavily focused on engineering, manufacturing, and health-care related jobs. Nearly all of our 528 graduates will become teachers –after completing either their masters or their doctorate. So, please remember that, while engineers make bridges and cool gadgets and doctors make people better, teachers make engineers and doctors.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The 528 extended major requires 51 hours of mathematics and no minor, and is designed for students who intend to pursue graduate study in mathematics. Many Gatton Academy students enroll in courses in this program, and they contribute to the dynamic of highly motivated students in the program.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The existence of undergraduate majors in our department has enabled us to attract and retain an extremely high quality of tenure-track faculty over the past decades (3 UDP's, 1 university research award winner, perennial "favorite teachers", several junior faculty that are thriving). These teachers provide instruction to many other majors in Ogden College (engineering, physics, etc.), and they would not have even applied to work at WKU if we did not have undergraduate majors. I do not see that reality addressed anywhere else in this "comprehensive assessment".

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We tend to consider recruitment strategies for a math major in general, and then direct students to the correct version (528, 728, or 731) based on their career plans. About half of our recruiting takes place in our entry-level and upper-level classes, particularly for the 528 major, which is often picked up by students switching from the 728 major. The other half show up at WKU ready to major in mathematics. We have a team of 2-3 Math Ambassadors that attend Head for the Hill events, and used to attend recruiting events set up by the Office of Admissions, but individual departments are no longer invited to these events, so our off-campus recruiting is largely at the mercy of Admissions personnel.

We still work very hard to retain students in the 528 program, and will continue to do so.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The number of bachelor degrees in math and stats has risen slowly over the last five years, although the total WKU enrollment has gone down.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

In November 2018, the department passed a proposal to adjust some of the auxiliary requirements from outside the mathematics department. The requirement of a logic course offered by the Philosophy and Religion department is being dropped, and the list of acceptable courses meeting the two-course computing requirement has been updated. Scheduling bottlenecks have been eliminated by increasing the number of sections of MATH 237, MATH 310, and MATH 331 to meet demand.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

We would like to see the program continue at its current strength, if not a bit higher enrolled. As we have said, the 528 major is only for a selected niche of students majoring in math with the intent of going to graduate school in math, so it likely will always be a fairly small cross-section of our students.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Mathematics (minor required)
Reference Number:	728
CIP Code:	270101
Degree Type (AB, BS, etc.):	AB
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	39
List Concentrations (if any):	General and Teacher Certifiable

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

This is our regular math major, that requires a minor or second major. Students wishing to gain certification to teach at the secondary level will take the teacher certifiable track, and will double major in Science and Math Education (SKyTeach). A significant number of students taking the general track are taking math as a second major while their primary major (and career destination) is a related field in Ogden College.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	63	52	48	49	53	89
Conferrals	17	9	9	7	8	22
SCHP	511	477	458	512	492	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

A large number of the courses that are taken by our 728 majors are also taken by students from majors in other departments (engineering, physics, meteorology, etc.) and all courses are shared with the 528 and 731 majors. All students taking the teacher certifiable track (roughly half) will also double major in Science and Math Education (SKyTeach). Roughly half of the students taking the general track will be using the math major as a second major to another science-related major in Ogden College.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

This major shares courses with the 528 and 731 majors, so it makes more sense to look at their combined productivity, as the total enrollment and SCHP in the three majors is a more accurate measure of total productivity.

The shortage of qualified math teachers is a well-known issue (https://www.bgdailynews.com/news/wku-working-to-address-teacher-shortage/article_d61da508-0361-54d6-a8d5-194eae4eb305.html). Of the 6 math teachers graduated from WKU in Fall 2019 (referenced in the article), this major contributed the only secondary-certified math teacher. (The other 5 are middle-grades certified.)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	12	83.3	10	100	8	62.5	8	62.5	3	100	69.4%
Progression			35	80	38	73.7	38	76.3	37	78.4	61.3
150% Graduation Rate	3	66.7	16	62.5	16	50	10	50	12	41.7	54.1
Time to Degree	4.90		5.71		3.48		4.24		5.59		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Outcome 1. Students will be prepared for employment in government, industry, or academic settings.
Assessment: Employment prospects of seniors will be monitored in an exit survey.
Assessment: Feedback from recent graduates will be monitored at the Career Options Panel at annual WKU Mathematics Symposium

Outcome 2. Students will be able to use technology and apply mathematics to solve problems effectively.
Assessment: Technology usage will be monitored in an exit survey.
Assessment: Problem solving will be monitored in all courses and in a required capstone project.

Outcome 3. Students will have well-developed abilities to utilize critical thinking and communicate ideas effectively.
Assessment: For each senior, a committee of three graders will review a 11-15 page paper and a 25-minute presentation on the student's capstone project.

Closing the loop: Due to demand from students and employers in recent years, the department has increased offerings in statistics.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Exit surveys are given to all graduating seniors. Placement of students in careers and graduate schools is monitored on a more personal basis than a systematic basis. Careful monitoring indicates that the demand for graduates of our program remains strong. Graduates of this program mainly find employment in secondary education or businesses and industries. Our graduates have found employment at Fruit of the Loom, Mammoth Cave National Park, and several insurance companies.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Each year at the WKU Mathematics Symposium, we have a Career Opportunities panel with about four panelists. The panelists discuss employment opportunities in their chosen path and indicate the courses and skills which are important to their career. Such feedback has led to increased offerings in statistics.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The demand for mathematics majors remains strong.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Mathematics faculty teaching 728 coursework have brought in grant funding totaling $15,676 in 2015-16, $46,626 in 2016-17, and $122,832 in 2017-18. While these amounts may not sound large in comparison to disciplines that have heavy machinery and consumables requirements, remember that research in mathematics does not typically have these requirements, and that most of our funding went into summer pay for faculty, and support for undergraduate and graduate students.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

This program shares substantial coursework with 528 and 731.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The 728 program hosts a diverse body of students (p. 6), with students from all over the world. The large majority of these students complete the program and go on to be successful (p. 7) in getting into a graduate program with an assistantship. Our 728 graduates are prepared for the global stage (p. 7) after completing their coursework, and many have contributed to the research and creative activities (p. 11) of a faculty member who supervised their research. In fact, we have had 10 joint publications with faculty and undergraduate math majors in the last five years. We feel that the 728 program has contributed to WKU's goal of global learning (p. 15), by providing a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The diverse backgrounds of our 728 students (mentioned above) and our graduate faculty (with 10 different countries of origin) address Objective 1. The high and timely completion rate of the students in the 728 program addresses Objective 6. Our highly effective graduate faculty, three of which have been named UDP's and one of which has won the university's research award, address Objective 8. The research and grant productivity of those faculty, often with the aid of students in the 728 program, addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Future Skills Report seems to be heavily focused on engineering, manufacturing, and health-care related jobs. Roughly half of our 728 graduates will become high school teachers. So, please remember that, while engineers make bridges and cool gadgets, and doctors make people better, teachers make engineers and doctors.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

Many Gatton Academy students enroll in courses in this program, and they contribute to the dynamic of highly motivated students in the program.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The existence of undergraduate majors in our department has enabled us to attract and retain an extremely high quality of tenure-track faculty over the past decades (3 UDP's, 1 university research award winner, perennial "favorite teachers", several junior faculty that are thriving). These teachers provide instruction to many other majors in Ogden College (engineering, physics, etc.), and they would not have even applied to work at WKU if we did not have undergraduate majors. I do not see that reality addressed anywhere else in this "comprehensive assessment".

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

We tend to consider recruitment strategies for a math major in general, and then direct students to the correct version (528, 728, or 731) based on their career plans. About half of our recruiting takes place in our entry-level and upper-level classes, particularly for the 728 major, which is often picked up by students already majoring in another Ogden discipline. The other half show up at WKU ready to major in mathematics. We have a team of 2-3 Math Ambassadors that attend Head for the Hill events, and used to attend recruiting events set up by the Office of Admissions, but individual departments are no longer invited to these events, so our off-campus recruiting is largely at the mercy of Admissions personnel.

We still work very hard to retain students in the 728 program, and will continue to do so.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The number of bachelors degrees in math and stats has risen slowly over the last five years, although the total WKU enrollment has gone down.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Scheduling bottlenecks have been eliminated by increasing the number of sections of MATH 237, MATH 310, and MATH 331 to meet demand.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

We would like to see the program continue at its current strength, if not a bit higher enrolled. It is not a great time of encouragement right now for students to pick a teaching career, with the controversy that has surrounded the funding of public school teachers' pension program, but while that is out of our control, we are hopeful that progress with be made in funding for teachers' pensions and salaries.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Mechanical Engineering
Reference Number:	543
CIP Code:	141901
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	122.5
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Mechanical Engineering (ME) program at WKU focuses on a solid understanding of engineering science, which includes mechanics, engineering materials, thermodynamics and fluid mechanics as well as design and professional skills necessary for a successful career in mechanical engineering. ME graduates have a strong competitive advantage with their unique background of engineering fundamentals combined with practical knowledge and experience. This program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The program is offered face-to-face with occasional technical electives offered online from UK. No minor, second major, or certificate is required.

ME students take the following supporting courses outside of the major in addition to Colonnade courses:

- MATH 136,137, 237, 331
- PHYS 255, 256, 265, 266
- CHEM 116/106 or 120/121
- EE 210

Students are also required to choose one math/science elective course from outside of the program.

Students are admitted as a Pre-Major in ME. To transition from Pre-Major to Major, student must complete the courses listed below with a grade of "C" or better.

- College Composition
- Human Communications
- MATH 136
- MATH 137
- PHYS 255/PHYS 256
- CHEM 116/CHEM 106 or CHEM 120/CHEM 121
- EM 222

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	295	361	360	312	315	89
Conferrals	20	18	36	37	38	22
SCHP	1949	2636	3224	2947	3153	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This project-based and applied learning nature of this program supports both the WKU mission ("prepares students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society") and the Ogden College of Science and Engineering mission ("empowering individuals to become leaders through academic achievement, global connections, and engagement in research, education, and service").

This program offers courses in mechanics (EM 222 and EM 303) that are required for civil engineering students and are electives for electrical engineering students. All faculty in the program also participate in the multi-disciplinary senior project course sequence by sponsoring teams of students to solve real-world problems.

Any student can enroll in the ME pre-major regardless of preparedness to be successful in the major. There is a significant number of students who declare ME as a pre-major that will change majors due to the math and science rigor required in the freshmen and sophomore year classes. The fluctuation in enrolled students shown in the table above was due to a large influx of international students into the pre-major. However, the SCHP has remained high which indicates that a large and stable number of students in the major.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Successful engineering graduates must be able to use their foundation in engineering problem solving to grow in the profession to meet the demands and challenges of the rapidly changing technological landscape. To meet this need, the ME program has a long history of offering engineering education where students can engage in a wide range of projects while learning the fundamentals of mechanical engineering. The program has many lab and project intensive courses that impacts the class sizes offered. Faculty have high loads to meet the demands of a large student population in a program with a project-based mission.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	49	79.6	93	84.9	75	80.0	62	80.6	70	78.6	69.4%
Progression	NA	NA	306	46.4	301	62.1	252	59.9	209	62.7	61.3%
150% Graduation Rate	42	50.0	43	44.2	37	40.5	37	54.1	49	61.2	54.1%
Time to Degree	4.76 (N=19)		4.85 (N=17)		4.63 (N=36)		4.58 (N=37)		4.48 (N=38)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

A significant amount of time is devoted to the execution of an assessment plan in support of ABET (www.abet.org) accreditation. The program faculty develop program objectives and outcomes; evaluate courses, learning outcomes, resources, student progress; and seek input from constituents on an ongoing basis.

The ME program student learning outcomes (SLOs) are as follows:

Mechanical Engineering graduates have an ability to…

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

The program uses a variety of metrics to assess these SLOs as a part of the ABET assessment plan, including internal and external rubric assessment, student performance in classes and external activities, and student/graduate self-assessment surveys. The program then creates an action plan to improve the program. The above outcomes were adapted in 2017, at the same time program changes were made based off previous assessments. The most recent closing of the loop was to change the requirements for transition to the major by reducing the course set required. The faculty are monitoring the consequence of this change to determine if it creates the desired result.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

WKU ME students have multiple opportunities upon graduation. Most graduates are employed in the South-Central Kentucky region after graduation. Several students have also pursued graduate degrees after graduation.

To support graduate employment, a part time industrial liaison disseminates of job and internship opportunities and assists students in development of professional skills such as resume writing and interviewing. Since the liaison began working at WKU in May 2017, she began surveying graduates last spring for post-graduation employment information. The key areas of

professional opportunity for students graduating from this program is in engineering roles in a variety of sectors which includes manufacturing and research and development.

Defining program constituencies and contacting these constituencies for feedback on the program education objectives is required for the ABET assessment process. One of the program constituencies for the ME program are the students who are included in the assessment process of the program.

According to Kentucky Statewide Occupational Employment Outlook, the demand for mechanical engineers will increase 14.2% from 2014 to 2024. Nationwide, the demand for mechanical engineers will increase by 5.3% in the same time period with a median average salary of $83,590.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

As part of the ABET assessment plan, the program has established the Mechanical Engineering Industrial Advisory Board composed of industrial representatives across the region. The board usually meets annually to provide feedback on the program activities and student success. In addition, the faculty interact with many industries each semester via student engagement and scholarship. Activities directly impacting students include visits to industry, industry sponsorship of student projects, and industry assistance in reviewing student academic work.

The Engineering Industrial Partnership is a group of fifteen companies that pay an annual membership to support the engineering programs. The partnership meets formally twice a year to provide feedback on the success of the engineering students in their various companies.

Feedback from constituencies informs the program of current industry needs and this information significantly impacts portions of the program. Because of this feedback, the materials and manufacturing courses have been enhanced and a certificate program in Engineering Materials has been discussed. Moreover, a Systems Engineering Minor was implemented in 2013.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Nationally, engineering programs see substantial attrition in the first few semesters due to many factors including lack of preparation for an engineering curriculum. According to one source, "A gulp-worthy 60% of freshmen engineering students eventually drop-out or change majors. Over 40% don't even make it through year one. The primary reason why students drop out of engineering programs is a lack of preparedness for the high level of rigor."

However as seen from the data above, the ME program at WKU has retention and student success averages above the university average. The faculty believe this is attributed to the project-based nature of the program and the interaction of faculty and students.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					5	12
Number of NTE Faculty					2	4
Cost per SCH					$162	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Faculty members in the ME program have received $46,228 in the past five years to support research and student projects. A faculty member in the program holds an endowed professorship position with an average endowment of $18,627 over the past five years. The Layne professorship funds are designated support project-based engineering education.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. A program fee and course fees help the sustain program.

The cost per student credit hour for the program is higher than the university average however this phenomenon is true across the United States. The WKU ME program produces a high number of graduates and student credit hours while delivering a project-based engineering program.

The student to faculty ratio is 45:1.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the ME program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry. Due to the nature of the project-based program, ME students learn to think critically and solve problems supporting another aspect of the strategic plan ("ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others").

Another part of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has several HIPs embedded including a required capstone design course sequence. Also, the culture of the program is such that most students participate in internships facilitated by the industrial liaison.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges." The program solves industry and community problems in the project courses throughout the curriculum.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 7.2: Increase 2-year to 4-year transfer by providing more degree pathways, completer (2+2) programs, and transfer advising. *A memorandum of understanding has been signed with SKYCTC so that students who complete a 2 year degree in pre-engineering can earn a mechanical engineering in 2.5 additional years.*
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research. *ME students participate in applied research throughout their academic career through the project-based nature of the program.*
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The engineering programs at WKU were created in 2001 to increase the number of engineering graduates per capita. The Commonwealth of Kentucky ranked 46th in science and engineering graduates per capita in 2016.

The ME program produces graduates that are employed in virtually every industry/technology sector and is the least likely of all majors for underemployment. Approximately 90% of WKU ME students improve readiness for employment through internship or practical work experience. The majority have employment secured by graduation, and 95% within 2 months of degree completion. Some choose graduate studies at universities who typically offer full support as RAs or TAs.

Present and future demand as indicated by the United States Bureau of Labor Statistics (BLS), National Association of Colleges and Employers, and surveys of regional industrial companies likely to employ WKU ME graduates show the national average salary for ME majors in manufacturing was $64,448, and overall by major was $65,557. Employers in Warren and surrounding counties offer the average indicating a strong demand in this low cost of living region.

According to the BLS, employment of mechanical engineers is projected to grow 9% from 2016 to 2026, faster than the average for all occupations (7%).

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

Of the three ME programs in the state (UK, UofL, and WKU), the WKU ME program is unique in that it provides an undergraduate-only project-based, learner-based curriculum across all four years. In support of this learning environment, the professional engineering activities of the faculty create opportunities for the students to practice the art and science of contemporary Mechanical Engineering, in and out of the classroom. Our graduates have a strong competitive advantage with their unique background of engineering fundamentals combined with practical knowledge and experience.

The program welcomes all students to the program, working closely with regional campuses and KCTCS to provide a pipeline to the ME major. Over the last 5 years, international students have added to the diversity of the student body. In addition, a new agreement with SKYCTC for a 2+2 ME program will widen the range of students entering the program.

The program utilizes the services of DELO to facilitate the use of online technical electives from UK to broaden the technical range of the program.

The ME program was a recent participant in an NSF grant-funded "Pathways to Innovation" project, working to improve the entrepreneurial engagement of students.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

All engineering faculty at WKU are required to obtain and maintain a Professional Engineering license in Kentucky before tenure and first promotion, with anecdotal evidence that WKU is the only institution in the US with this requirement. The faculty believe this fosters a sense of preparation for professional practice in the students, helping them to be "*work-ready and fully prepared to pursue meaningful careers and lives*." The project-based philosophy of the program is unique in the state. WKU is increasingly an institution of choice for the study of mechanical engineering.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The program is well positioned to provide a traditional BS ME degree, with an emphasis on professional project-based learning experiences throughout the curriculum. Interdisciplinary connections exist through the reorganization of the program within the School of Engineering and Applied Sciences. Since 2010, the number of ***true ME students*** defined as students taking required ME courses has more than doubled from about 150 to over 300. The number of students entering the program each year (i.e. enrolled in ME176) averaged 75 a decade ago, and now averages nearly 120 which is approximately half of all of the new engineering majors at WKU. To move forward the staffing of the ME program to handle this significant enrollment increase needs to be addressed.

The program sees opportunities for collaboration with other WKU disciplines such as world language and entrepreneurship to create concentrations or tracks within the program.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The number of graduates with bachelor's degree from US engineering programs increased by 7.5% from 2014 to 2015 which has been an ongoing growth trend for the past decade. The ME program has experienced an average annual growth rate in students actually taking required ME classes of 12% over the past seven years. ME graduates are successful in finding engineering jobs with starting salaries comparable to national averages either upon graduation, or soon after.

The ME program is producing graduates at an increasing rate that exceeds the national rate increase, and at a quality level that is valued by local and national companies.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

One of the main changes was to consolidate the senior design sequence into common courses for all three engineering programs. To facilitate student progression, the entire ME design sequence is now offered every semester due to the number of majors. Changes to the requirements for pre-major to major transition were also initiated and coordinated amongst the three engineering programs. It is expected that this will improve efficiency in faculty time and produce efficiency across the programs. As we assess these changes, the same approach for commonality and consistency in other courses may be possible.

Ongoing efforts are underway for better coordination of ABET activities between three engineering programs. The ME course prerequisites were examined and modified for some courses to ensure courses are taken at the appropriate time in the curriculum. It is expected that the new prerequisite set will help students to take courses in the logical, required sequence and improve students' performance in some courses.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

To keep the ME program current and make it more attractive for future students, the faculty will continue to evaluate the curriculum while considering emerging technologies. Curricular changes will be made to prepare students for the future job market.

Employment of mechanical engineers is projected to grow 9 percent until 2026. Mechanical engineers can work in many industries and on many types of projects. As a result, their growth rate will differ by the industries that employ them. Mechanical engineers will remain involved in various manufacturing industries, particularly in automotive manufacturing. Therefore, it is reasonable to assume the ME program will continue to grow as more students choose it as their major.

With the current very limited resources, it will not be possible for the School of Engineering and Applied Sciences to accommodate the likely growth in the ME program. Considering the recent doubling of students, the program would need more lab space and more faculty members to support any growth in the future. Whether though added faculty, or replacing lines vacant from retirement**, maintaining the culture of project-based learning and the link to the industrial world we serve must remain a priority**. The program cannot continue to grow without additional resources.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Biology
College:	OCSE

Program Name:	Medical Laboratory Science (previously Medical Technology-#582)
Reference Number:	5004
CIP Code:	511005
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	83 plus 36 clinical hours
List Concentrations (if any):	N/A

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Medical Laboratory Science (MLS) Program (formerly Medical Technology) is a 3+1 program where students complete three years at WKU and a one-year internship at an affiliated school of MLS. This program combines a minimum of 83 hours of college credit taken at WKU with a minimum of 36 semester hours at an approved MLS clinical training school; these hours are transferred back to WKU. Affiliation agreements with the MLS schools require approval by NAACLS (National Accrediting Agency for Clinical Laboratory Sciences), which monitors program quality. Acceptance into an affiliated school is not automatic, but requires students to complete an application and interview process. If accepted, students can complete the internship in one year and the entire program in four years, then take the national accrediting exam to become a certified laboratory scientist. Most graduates obtain employment in hospital laboratories in Kentucky. Overall, there is a shortage of Medical Laboratory Scientists nationwide and in Kentucky. This program does not require a minor but does require Chem 120/121, Chem 222/223, and Chem 340 as supporting classes. There are no specific admission criteria, but the students have a rigorous curriculum.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR Data in red are from the obsolete major title.	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students- Medical Laboratory Science (previously Medical Technology) (#5004)	0	0	0	25	17	89
Enrolled Students- Medical Technology (currently- Medical Laboratory Science) (#582)	27	28	27	3	0	89
Conferrals-Medical Laboratory Science (#5004)	0	0	0	0	2	22
Conferrals- Medical Technology (#582)	3	2	3	1	0	22
SCHP – Medical Laboratory Science (#5004)	0	0	0	158	237	991
SCHP-Medical Technology (#582)	220	206	207	46	0	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The MLS program meets the mission of WKU by preparing students of all backgrounds to be productive, engaged, and socially responsible citizen-leaders of a global society, who contribute to the health of members of the society. It enriches the quality of life for students pursuing this degree and the health of the citizens of the Commonwealth. The MLS program provides graduates of WKU a skills-based career in the medical field that can be completed in four years without graduate coursework, putting students in the workforce in high demand careers quickly. This major is an option for students who were originally pre-medical but would struggle for admission to a medical school. The major shares courses during the first three years with Biology and Chemistry majors.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Although the number of graduates per year in this program are small, to date there is 100% placement rate for WKU students after graduation and **100% pass rate** on the national accrediting (NAACLS) exam. Because students in this program take much of the same coursework as students majoring in biology (#617) the cost to the department is nominal. The cost of the clinical year faculty is paid by the affiliated school of MLS as outlined by the affiliation agreement, but the hours transfer back to WKU's program. This is a cost saving feature of the program, as students are not on the WKU campus and not taught by WKU faculty during their senior year.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate-MLS (#5004)	0	0	0	0	0	0	0	0	10	50%	69.4%
First-Year Retention Rate-Medical Technology (#582)	7	71.8%	6	50%	5	60%	7	71.45	0	0	69.4%
Progression-MLS (#5004)	-	-	0	0	0	0	7	71.4%	13	38.5%	61.3%
Progression-Medical Technology (#582)	-	-	21	47.6%	25	44%	17	17.6%	0	0	61.3%
150% Graduation Rate-MLS (#5004)	-	-	-	-	-	-	-	-	-	-	54.1%
150% Graduation Rate-Medical Technology (#582)	7	42.9%	11	54.5%	9	33.3%	4	25%	7	14.3%	54.1%
Time to Degree-MLS (#5004)	-		-		-		-		4.00 (n=2)		4.39
Time to Degree-Medical Technology (#582)	4.22 (n=3)		4.00 (n=2)		5.00 (n=3)		4.67 (n=1)		-		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

The overarching learning outcome for this program is to prepare students to gain the knowledge and skills necessary to become a MLS, measured by acceptance into an affiliated MLS school and transition into the market. The major learning objective is successfully passing the NAACLS accreditation exam. We work with the affiliated MLS schools to align our program of study with the demands of the school. The MLS school must maintain accreditation and go through a self-study and review process, which requires us to track success of our graduates. More specific learning objectives are defined in each individual course required by the program and are measured on exams. Two examples of how we have improved the program after the last NAACLS accreditation (closing-the-loop) were to change the name of the program from Medical Technology (implying a technical college degree) to the more modern Medical Laboratory Science to attract more students to this field of study and to alter the required courses in the program. We modified the curriculum to include Biochemistry as a required course, deemed key to student success after the NAACLS review.

Conferral of credits and degree occurs when students successfully complete their clinical year, which not all do in a timely fashion, partly explaining the low progression and conferral rates in this program. Very limited seats are available at contract MLS schools (4-6 seats at Owensboro Health System, 8-12 at Vanderbilt, 6 at St. Elizabeth; **our students must compete for these seats with all applicants**). Another factor that explains the low degree conferral rate is the demographics of many MLS majors; many are transfer students and part-time, non-traditional students, delaying their eligibility to apply to the clinical year. Some students enter WKU as MLS majors suggested by high school guidance counselors when students are interested in majoring in "something medical" without understanding this career. These students often change their major. These factors explain the low conferral rate relative to number of majors.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Through partnering with our affiliated schools of MLS and participating in their NAACLS accreditation process, we gather data on our students' employments and success. We boast 100% placement rate for our graduates and 100% pass rate on the NAACLS exam. Student satisfaction surveys are also given during this process, in which this program receives high marks. Kentucky's Post-secondary Feedback Report shows the outlook for students pursuing a bachelor's degree in Clinical/Medical Laboratory Science is high, with 75% of employment occurring in healthcare. Projected average salaries from this report are between $41, 907-$52,437 (3-7 years). Most of our graduates obtain employment in hospital laboratories. Recent graduates for WKU's program have obtained employment at University of Kentucky Medical Center in Lexington, Hardin Memorial Hospital in Elizabethtown, Owensboro Health System (3), Medical Center in Bowling Green, Medical Center at Caverna/Horse Cave, and Floyd Memorial Hospital in New Albany, IN.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The affiliated schools of MLS must maintain NAACLS accreditation. As a part of the review process for this accreditation there are requirements to survey the employers and to establish advisory boards. The program at WKU works closely with the affiliated schools during this process and the information is shared. One faculty member from WKU sits on the Advisory Board for Owensboro Health's program (this is the program most of our students attend) so that the flow of information is seamless. We also consider the recommendation of NAACLS for coursework in our programs. One of the best examples of how information gained was used to improve the program was the changing of the curriculum at WKU to include Biochemistry after a NAACLS review. This course was not previously in the program but was suggested to improve our students' background knowledge in this area. The affiliated schools of MLS are often hospital-based (as in Owensboro) or have hospital-based components (such as Vanderbilt). Students in the clinical year rotate through the divisions of the lab (such as chemistry, blood bank, microbiology) obtaining skills necessary for employment.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

MLS is a small program with great impact on healthcare in Kentucky. It is a program that requires few additional resources from the university because it runs in tandem with the Biology major but produces professionals that meet the needs of qualified laboratory scientists for Kentucky. Students who are successfully admitted to the clinical year at an affiliated school of MLS have a 100% pass rate on the national exam and 100% placement rate after graduation.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR In red, calculated by dept.	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					1	12
Number of NTE Faculty					0	4
Cost per SCH					274	128
SCHP/FTF by Dept.	n/a	n/a	n/a	n/a	237	375
% SCH by FTF by Dept.	n/a	n/a	n/a	n/a	100	75.8
Median Class Size UPPER Level					N/A	
% Under-Enrolled Sections by UPPER Level					N/A	

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The WKU Foundation has established the Larry Elliott Scholarship Fund to support a student in their clinical year. This fund relies upon donations.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The cost of maintaining the MLS program is nominal because the courses required in this program mirror the courses taught in other Biology majors (#617 & 525) thus requiring no extra effort on the faculty to add these students to the course. The salary of the clinical faculty is paid by the MLS school/hospital at no cost to WKU. One faculty member from WKU does serve as the primary adviser to this major and upholds affiliation agreements, works with NAACLS accreditation and maintains the curriculum for the program. Biology does incur administrative and advising costs associated with this program.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

- The MLS program ensures WKU students' completion and success as it is designed for students to complete it in 4 years and obtain successful employment directly after graduation. Students who successfully enter their clinical year meet this goal.
- This program prepares students for a career that can be taken anywhere. There are needs for medical professionals in the state, the nation and around the world. Global travel is not required, but encouraged.
- This program recruits all students and seeks to practice equity in helping all students achieve success.
- This program provides resources, attracts talent, and nurtures intellectual capital in the communities we serve. With healthcare needs being high in the state, the MLS program provides talented, trained and skilled professionals to fill the needs in the lab. The MLS program seeks to attract talented students from the Commonwealth into this program.
- MLS improves the quality of life regionally and supports regional economic diversification by improving healthcare it improves the quality of life in the region. The MLS program improves healthcare by insuring qualified personnel are running tests that determine treatment in our regional hospitals.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The MLS Program at WKU specifically addressed Objective 4 of the statewide strategic plan agenda to improve the education and skill levels of Kentucky Adult Education students to prepare them for careers and/or post-secondary education.
This program helps to insure that graduates will earn degrees and credentials that provide skills and abilities to be productive and engaged citizens. Healthcare is a growing field where the demand is high in many areas. Education and training is required to obtain careers in healthcare. The MLS program educates students to work successfully in a hospital laboratory. The MLS program has a 100% placement rate for graduates in this field. Students who begin a program of study in MLS and complete the degree will be prepared for a career that is in demand in the state.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Occupational Outlook and the Kentucky Future Skills Projection both report major job growth in the area of healthcare. MLS currently represents 2328 jobs in Kentucky with a projected need of 569 jobs in the next five years. The US Bureau of Labor Statistics forecasts a 16% job growth in this field between 2012 and 2024. The Kentucky Occupational Outlook reports MLS to be a very fast growing field in the next 5 years with a projected weighted mean wage of $59,175. Jobs will be in all regions of Kentucky, with the lowest projected wage being $51,652. In Northern Kentucky the projected weighted mean wage is $68,983. In South Central Kentucky there are 30 projected job openings in the next five years with an average projected wage of $57,699. The MLS program seeks to help fill the need in healthcare for qualified MLS. Retiring laboratory scientists and increased demand for healthcare in the state has placed a high demand on these professionals. The MLS program at WKU works with hospital-based schools of MLS to create a pipeline for these scientists in the state.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The MLS program is distinctive in that it is a cooperative program with affiliated schools of MLS where students gain direct, hospital-based skills to successfully sit for the NAACLS exam and become an accredited MLS. Students can directly enter the workforce after four years and impact healthcare in Kentucky. The MLS program has a high pass rate on the national exam and a high placement rate for graduates. It impacts Kentucky and the community

by providing competent healthcare workers in the lab. Similar programs in MLS are offered at Eastern Kentucky University, Morehead University, Northern Kentucky University, University of Kentucky but the graduates of these programs typically serve other areas of the state. The program at Eastern differs from WKU in that the third year is specific for MLS (does not overlap with Biology degree) and is offered on campus. WKU's MLS program has a good reputation in the state and its graduates are in demand.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

This program offers students an alternative career in healthcare that does not deal in direct patient care. It helps meet the needs for qualified laboratory personnel in hospitals in Kentucky. It creates partnerships between WKU and affiliated clinical hospital laboratories.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The demand for MLS is clearly increasing. Healthcare is a sector of employment that is in high demand and MLS is exemplary of this trend. Aging populations and retirement of the current workforce are factors that put additional stress on healthcare. There are opportunities for expansion of the MLS program at WKU. The main potential for growth is better marketing of the program at WKU and in the community to make students aware of this career path. We could develop an MLT (Medical Laboratory Technician) to MLS program so that technicians in the field could advance their education and sit for the national accrediting exam.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The National Center for Educational statistics reports that healthcare related degrees are the second largest occupational group of conferred degrees nationally (behind business). Of the 1,791,046 bachelor's degrees conferred in the US in 2011-2012 (reported by NCE), 2596 were granted in Medical/Clinical laboratory science. While the overall number of degrees conferred in the health related fields has increased as much as 67%, this has not been the case nationally for MLS. The trend for the number of students nationally graduating from MLS programs is fairly flat, adding to the demand for graduates. The program at WKU follows this flat trend, producing fewer graduates than demand. This is a reason why MLS is in the "very fast growing" category for careers in Kentucky. This is encouraging for students entering this field of study who should easily find employment.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

After the last NAACLS accreditation, we made changes in the program to increase productivity and to maximize the success of our students. The results of these recent changes are not evident yet. To enhance recruitment of students, we changed the name of our program from Medical Technology to Medical Laboratory Science. Medical Laboratory Science/Clinical Laboratory Science is the name of the four-year program specified by the American Society for Clinical Laboratory Sciences (ASCLS) and the American Society for Clinical Pathology (ASCP). The change reduces misconception that the degree is a two-year degree rather than a four-year degree. We hope that this will attract more students to the major. We also changed the curriculum by moving Quantitative Analysis from a requirement to an elective instead and adding Biochemistry to the list of required courses. Affiliated faculty at the MLS schools suggested these changes because much of the quantitative analysis done in the hospital labs is automated and understanding Biochemistry is important to student success in the program. In addition, removing Quantitative Analysis alleviated scheduling constraints for students who often struggled with scheduling around this course.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

There is the potential for growth in this program. It is a rare program that can boast 100% placement rates after graduation. However, many students are not aware that MLS is an option. Better marketing of the program through educating high school counselors, creating websites that are detected by search engines, stronger partnerships with hospitals and outreach to WKU organizations, such as the Microbiology Club and TriBeta, are potential marketing grounds. However, these efforts require time and effort by faculty who are already strained to advise and prepare current students. Incentives or increased personnel would be necessary to move this to another level. Another constraint to growth is the limited seats at clinical schools. This could be overcome by developing new partnerships with new programs, which would require more time on the part of the faculty. The Biology Department just lost its primary cell biologist, replacing that position is essential to the success of this program as many aspects of MLS jobs are cell-oriented, such as blood testing. Increasing microbiological instructional capacity in the Department will make the program more attractive to a wider set of students and employers.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Geography and Geology
College:	Ogden College of Science and Engineering

Program Name:	Meteorology
Reference Number:	578
CIP Code:	400404
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	48
List Concentrations (if any):	None

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The B.S. in Meteorology degree at WKU is the first and largest meteorology program in Kentucky or Tennessee that meets all the Federal Civil Service requirements (GS-1340) for employment by the National Weather Service and enables TV broadcast meteorologists to immediately pursue the "Certified Broadcast Meteorologist" program of the American Meteorological Society upon graduation. In addition to preparing students for immediate employment as meteorologists, the combination of advanced theoretical and applied coursework as well as experience with meteorological instrumentation and computer programming provides a foundation for students who wish to pursue graduate school in the atmospheric sciences. The WKU Meteorology program is affiliated with the Kentucky Mesonet, Climate Research Lab, and the State Climate Office, which allows the WKU Meteorology program to offer a more comprehensive curriculum with multiple meteorology electives compared to programs in nearby states.

The B.S. in Meteorology degree is taught entirely in-person and does not require a minor although over 75% of program graduates have earned at least one minor or second major. To meet GS-1340 requirements, meteorology students are required to take 25 hours of calculus and physics pre-requisites. There are no criteria for selective admission.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	67	64	60	64	74	89
Conferrals	5	7	6	6	10	22
SCHP	827	747	759	826	974	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

White Squirrel Weather (WSWX) is an applied research, professional work-force service-learning initiative at WKU comprised of students who provide real-time weather observations and public and privatized forecast content to the campus and community. The intent of this initiative is to improve hazards mitigation, emergency preparedness and management, and education outreach. As such, WSWX has been officially adopted as the university weather service and decision-support operative for WKU. In that way, WSWX develops employable students for post-graduate success, while providing tangible benefits across the university spectrum. Specifically, the Meteorology Program and WSWX work directly with these WKU entities: Athletics, Public Broadcasting, Campus and Community Events, Alumni, Environmental Health and Safety, Facilities and Management, Police, Human Resources, Admissions, Information Technology, Parking and Transportation, Intramurals, Band, Military Science, and the Army National Guard. President Timothy Caboni was recently quoted in the Bowling Green Daily News stating, "This is the best example that you can imagine of applied learning and applied research." Provost Terry Ballman stated, “this is a great example of student-centered applied research with impact on the region.”

WKU Meteorology also plays an important role in the Colonnade program at WKU with enrollment in METR 121 over 450 students in 2017-18.

c. What else should evaluators know about this program’s productivity? (optional, maximum 100 words)

The WKU Meteorology program is the largest program in the state of Kentucky and has a four-state region from which to draw students who can receive in-state tuition through the Academic Common Market. The Meteorology program attracts students nationwide and has begun to attract international students. Meteorology faculty have published over 50 peer-reviewed journal articles since 2011, including 16 published with current and former Meteorology program students. Ten students have won national scholarships. To support this research agenda as well as enterprises such as the Kentucky Mesonet, Meteorology program faculty have been awarded over $3,000,000 by external agencies since 2011.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	17	76.5	14	78.6	16	68.8	14	64.3	15	80	69.4%
Progression	NA	NA	45	55.6	46	58.7	42	73.8	48	58.3	61.3%
150% Graduation Rate	15	60%	12	41.7	12	58.3	18	44.4	17	58.8	54.1%
Time to Degree	3.40 (N=5)		3.95 (N=7)		4.67 (N=6)		4.06 (N=6)		4.00 (N=10)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Intended Education Student Outcome #1
Students completing the Meteorology program will be able to demonstrate understanding of the theoretical principles surrounding the basic equations and conservation laws that govern atmospheric motion and energy transfer. (*Theoretical Meteorology*)

Intended Education Student Outcome #2
Students completing the Meteorology program will be able to quickly and accurately analyze a randomly selected surface map and present a weather forecast discussion based on their analysis. *(Applied Meteorology)*

Means of Assessment for Outcome #1 Identified Above:
A comprehensive exam is given during the final senior semester to all students completing the Meteorology program. The exam consists of four questions that represent key concepts from each of the eight upper-division courses in the B.S. degree in Meteorology curriculum.

Means of Assessment for Outcome #2 Identified Above:
As part of Mesoscale Meteorology (METR 437), the capstone course in the weather analysis sequence in the meteorology program, students will be given a randomly selected surface map for analysis. Each week a different student will be responsible for leading a map discussion of current and future weather conditions.

Use of Results to Improve Instructional Program:
In combination with the above student assessment and an ongoing statistical analysis of Meteorology program students, the prerequisites of the 300- and 400-level courses were raised in 2014 to require a grade of C or better for METR 324, MATH 237, METR 431, and METR 432. Our assessment data showed that students who received a grade of D in any of those classes failed to graduate 90% of the time. By eliminating students who struggle with the foundational courses in meteorology, we are ensuring a stronger cohort of graduates who will be more employable and successful in their careers.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The WKU Meteorology program has a strong relationship with its alumni, due in large part to the quality of the educational experience and the high job placement rate for our graduates. We periodically send out questionnaires where alumni are asked to describe their current positions and job responsibilities as well as one fond moment from their days in the Meteorology program. The WKU Meteorology has had 55 graduates since

2010 and through the questionnaire (50% response rate) and social media we have remained in contact with all but two of them. Of the 55 alumni, 47 (85.4%) are currently working in a job related to either Meteorology or their minor. The other eight alumni are working in fields not related to their major or minor but nearly all of them chose not to pursue meteorology for either family or geographical reasons. Here are the career fields our graduates have pursued.

34% (16/47) – Weather Forecasting (National Weather Service, Air Pollution Forecasting, Private Sector)
21% (10/47) – Graduate School (Five PhD, Five MS)
19% (9/47) – Weather Broadcasting
13% (6/47) – Other (Consulting, Air Force Weather Officer, Emergency Management)
13% (6/47) – Minor related (Geographic Information Systems, Revenue Analyst)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The philosophy of the Meteorology Program is to emphasize employable skillsets as a core activity in the curriculum. The field of meteorology is quite competitive with regard to written and oral communication skills, computer skills, interpretative and independent problem solving, among others. Over the years, faculty remain in close contact with the top-sought employers in the field to collect necessary feedback regarding employable students. This information is brought directly into the classroom via assignments, activities, and initiatives. Further, faculty and students in the Meteorology Program routinely invite and host these employers (multiple times each semester) to give workshops, presentations, and network. Faculty and students in the program have also developed strong alumni relations for additional feedback and advice. We feel it is important for the students to hear the advice not only from their professors and mentors, but especially directly from employers and alumni for a well-rounded perspective on how to be successful upon graduation. In 2018 the WKU Meteorology Advisory Board (14 members) was created and is comprised of established, successful professionals and alumni across all sectors (government/NWS, broadcast, private sector, emergency management, and academic). Feedback from the Advisory Board will guide the WKU Meteorology Program into the future.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The WKU Meteorology Program has only produced graduates since 2010 so our alumni are still in the first decade of their careers. However the high job placement rate and the early success of our young alumni are positive factors for the growth of the program. Over 2/3 of our alumni (37/55) currently work outside of Kentucky, which increases the recruiting base of our incoming freshmen. Several of our young alumni are starting to receive promotions into leadership positions in the National Weather Service and two of our graduates who went to graduate school have recently completed their Ph.Ds.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					3	12
Number of NTE Faculty					0.5	4
Cost per SCH					$244.69 (IR) $150.33 (METR)	$128.00
SCHP/FTF by Dept.	306	405	414	384	374	375
% SCH by FTF by Dept.	78.6%	90.2%	88.1%	85.20%	92.50%	75.80%
Median Class Size by Level	18	15	12	15	19	19
% Under-Enrolled Sections by Level	28.6%	40.0%	57.1%	28.6%	14.3%	36.30%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The revenue streams flowing into the Meteorology Program are varied. Over the past decade, our program revenue has largely been traditionally furnished via internal and external grant support. However, over the recent two years, new revenue streams have emerged via philanthropic and corporate-university partnerships. The Meteorology Program has acquired over $6,000 in pure philanthropic donations since 2017, which has allowed for the development of a "Meteorology Foundation" account as a home to accrue continuous funding for student support. White Squirrel Weather has also developed significant relationships and partnerships with written agreements of financial support from national and international entities including, but not limited to WKU Public Broadcasting, NPR, PBS, Amazon Company, Jim Beam Suntory, with negotiations currently underway with other major groups across the region and United States. This new, alternative funding approach is paving the way for student funding, internships, and exciting opportunities to develop critical employable and unique skill sets. Consequently, student recruitment and retention continues to grow as post-graduate placement success is maintained by these funded professionalized experiences.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The Meteorology Program is the most efficient in the Department with respect to many efficiency metrics. The Meteorology Program has 41% of the current majors and 30% of the undergraduate SCHP produced in the Department, supported by only 17% of the FTF. The Meteorology Program also experienced the greatest growth in the number of majors over the five-year self-study period and the greatest percentage increase in conferrals. A significant driver of efficiency in the Meteorology Program is the every-other-year rotation of upper-division courses. In 2017-18, our upper division median was 19 students, with only one class below 15 students.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The WKU Meteorology Program aligns with several of the student- and community-center objectives outlined in the WKU Strategic Plan "Climbing to Greater Heights". One such objective is to "increase regional, national, and international conduits for attracting undergraduates". Since several nearby states lack a B.S. in Meteorology degree, residents of those states are able to attend WKU at in-state tuition rates. This has increased the proportion of out-of-state students to over 40% of all meteorology majors in recent years. A growing number of students are coming from states that are not part of the Academic Common Market, which means those students are willing to pay out-of-state tuition to attend WKU despite the presence of cheaper in-state Meteorology programs. Part of this growth in out-of-state students is attributable to the WKU Weather Camp, which is the only student-run summer weather camp for middle school students. The WKU Meteorology Program also aligns with the objective to "Prepare students for career and life in a global context" through the applied research and decision support of White Squirrel Weather. Students involved in White Squirrel Weather develop hard (weather forecasting) and soft (communication/problem solving) skills that are sought after in the meteorological job market.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The WKU Meteorology program aligns with several objectives of "Stronger by Degrees", especially those related to the "impact" portion of the strategic implementation plan. Specifically, the Meteorology program aligns with objective 9 (improving the career readiness and employability of postsecondary graduates) through the >85% employment rate of our meteorology graduates in jobs related to Meteorology or their minors. Objective 10 (increase basic and applied research) is addressed through our extensive undergraduate research opportunities. WKU Meteorology program faculty have published 50 peer-reviewed journal articles since 2011, including sixteen published with current and former Meteorology program students. Over 70 undergraduate students have presented research presentations at local, regional, and national conferences with several winning awards. To support this research agenda as well as enterprises such as the Kentucky Mesonet, Meteorology program faculty have been awarded over $3,000,000 by external agencies. Finally, we address objective 11 (expand regional partnerships, outreach and public service that improve the health and quality of life of Kentucky communities) through our many public service and outreach programs. These include the previously mentioned White Squirrel Weather, the Kentucky Mesonet, the student chapter of the American Meteorological Society/National Weather Association (AMS/NWA), and the WKU Storm Team.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The WKU Meteorology program has made contributions to the workforce and social welfare needs in Kentucky. Since 2010, eighteen Meteorology program graduates have become employed in science-related careers in the State of Kentucky with positions ranging from weather forecasters to broadcast meteorologists to air pollution forecasters. One alumnus created a weather forecasting business that hires current and former Meteorology program students. White Squirrel Weather provides real-time weather observations and public and privatized forecasts to the university and local community. White Squirrel Weather is in the process of developing

observation and forecasting relationships with private enterprises across Kentucky that will help those businesses improve the health and safety of their employees and better understand the influence of weather and climate on their businesses. Since the basis of the meteorology profession is to communicate with the public about current and future weather-related hazards, the graduates of the WKU Meteorology program have improved the social welfare of the citizens of Kentucky.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The biggest strength of the WKU Meteorology program is the wide variety of affiliated opportunities students have to turn their theoretical knowledge from the classroom into applied practical meteorology. When our students matriculate they can market a wide variety of practical skills that are in demand from employers. For example, students who complete the summer storm chase course "Field Methods in Weather Analysis and Forecasting" will have two weeks of intensive operational forecast experience in a high-stress severe weather environment. Students who engage with the faculty in research projects through the Climate Research Lab will have the experience of presenting their work at local, regional, and national conferences. Students who work with the CHAOS Lab and White Squirrel Weather will gain operational forecasting experience and learn about the challenges of forecasting and communicating the weather in high-stress environments and tight deadlines. Students who work for the Kentucky Mesonet learn skills related to the quality control of an intensive data-driven environment that generates over 100,000 data points on a daily basis. All of these opportunities provided by the Meteorology program to our students comes on top of the rigorous calculus-based curriculum that is the foundation of the Meteorology degree.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The Meteorology program occupies a unique niche at WKU as it is perhaps the one academic program whose teaching, research, and community outreach outcomes are useful to nearly everyone in the community. Press releases about recent weather events written by Meteorology faculty are among the most highly-read news articles on the WKU homepage. Weather observations, forecasts, and decision support produced by meteorology students involved with White Squirrel Weather support numerous WKU entities as the official weather provider of WKU. The annual "Storm Chase" class produces print and broadcast media coverage every summer as the public follows along with the students.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

There are three primary opportunities for growth with the WKU Meteorology Program. 1) White Squirrel Weather, while only active since 2016, has seen tremendous growth in the number of WKU entities that receive weather observations, forecasts, and decision support services. White Squirrel Weather is in the early stages of partnering with private businesses in Kentucky, an opportunity that has the potential to provide increased opportunities for Meteorology students to develop employable skills and network with professionals across Kentucky. 2) Broadcast Meteorology is a popular career goal for many of our students. 100% of graduates who have pursued a job in Broadcast Meteorology after graduation have not only found employment in that field but all of those students are still advancing in their Broadcast careers. We now have alumni working in the Nashville, Louisville, and Lexington markets, which will allow our current students to pursue internship opportunities in those markets and build their career networks. 3) Emergency Management has been a new avenue for growth for our alumni. The partnership between White Squirrel Weather and the Department of Environmental Health and Safety has led to discussion of a graduate program in Emergency Management that would involve meteorological education and training.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to the Bureau of Labor Statistics Occupational Outlook Handbook, jobs in the Atmospheric Sciences are expected to grow 12% from 2016 to 2026, which is faster than the average for Physical Scientists in general as well as all occupations. While Broadcast Meteorology and the National Weather Service will continue to hire the majority of meteorology graduates, the biggest area of growth for meteorology majors is in forecast services and hazard mitigation to businesses. The growth of weather analytics as a tool for businesses to improve supply chain management and transportation networks has led to numerous businesses, including Walmart, Mars Candy Company, and Waffle House, to maintain weather forecasting teams to provide decision support to business operations. In addition, the growth of renewable energy resources such as solar and wind power requires extensive knowledge of weather and severe weather forecasting as well as climatology to support the buying and selling of power. The growth of business-related weather forecasting in addition to the historical demand for public and broadcasting weather forecasting is what drives White Squirrel Weather as a job training tool for WKU Meteorology students.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

One of the challenges of the WKU Meteorology since its creation in 2008 has been the low graduation rate of incoming freshmen. From 2008-13 only around 20% of incoming freshmen went on to graduate within six years, primarily due to the challenge of completing the four-semester sequence of calculus courses that is the prerequisite for the upper-division meteorology courses. To address this, the focus of GEOG 175 (University Experience) was changed to retention. The biggest change was to make the culture of the Meteorology program more inclusive to freshman by integrating them into the three Meteorology clubs. There are mandatory one-on-

one meetings as a part of GEOG 175 to keep the students from slipping through the cracks. Since the focus on retention began in 2014, we now retain over 60% of incoming freshmen to graduation, which has allowed us to double the number of Meteorology graduates in 2018 (10) and 2019 (10 expected) compared to 2010-2017 (average of 5). The key to growth moving forward for the Meteorology Program is to increase the recruiting base through the WKU Weather Camp and White Squirrel Weather and then to increase the retainment of new students through advising and peer guidance.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The untapped potential of White Squirrel Weather has positioned the WKU Meteorology Program at the leading edge of a growth curve. The use of White Squirrel Weather as a marketing and recruiting tool combined with the growing number of out-of-state students means that in 5-10 years the WKU Meteorology Program has the potential to become one of the leading Meteorology programs in the United States in its ability to successfully train employable meteorologists who will be succeed in operational forecasting, broadcast meteorology, and emergency management. The biggest impediment to the continued growth of the WKU Meteorology Program is resources. There are only 3 Ph.D faculty that contribute to the teaching, research, and community outreach of the Meteorology Program. A full professor in the program left WKU last summer to pursue a leadership position at a climate research center at an R1 University. This faculty line was not replaced, which has left the Meteorology program short-handed, especially in research. The WKU Meteorology Program ideally needs one instructor line and one new tenure-track Assistant Professor line to maintain its record of faculty-student engagement in high quality research and to expand course offerings in such areas as climate change and applied meteorology.

e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
22 December 2018

Department/School:	Mathematics
College:	Ogden

Program Name:	Middle Grades Mathematics
Reference Number:	730
CIP Code:	270101
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	34
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

This is our major for students that want to be certified to teach mathematics at the middle-school level in mathematics. These students are required to take a second major in Science and Math Education (SKyTeach) for certification. Upon completion of this degree and subsequent passing of the Praxis, students are certified to teach mathematics in grades 5-9. Most courses are offered face-to-face with three being offered online (MATH 403, 411, and 413) and some offered IVS (MATH 302, 304, and 490).

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	73	78	82	63	59	89
Conferrals	22	19	22	19	19	22
SCHP	673	740	725	582	460	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

This program has a curious interaction with our other majors in the Math Department and the major for students wanting certification to teach at the elementary level. The 730 students take (previously) MATH 117 and MATH 136, which are courses taken by almost all science majors, but also take MATH 205, MATH 206, and MATH 308, which are taken by elementary education majors. Their upper-level coursework is either courses designed specifically for this major or courses that are also taken by 728 majors getting teacher certification for secondary teaching. We have seen a trend toward some 728 students in the teacher certification track picking the 730 as a third major (along with the Science and Math Education major for certification), to broaden the grade levels in which they will be certified.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

This has traditionally been a major that was attainable by students exclusively attending classes at the regional campuses. However, with regional campus attendance down, we are seeing a drop in the enrollments in this major from the regional campuses. We have also stiffened the major with the inclusion of a discrete mathematics course just for these majors, which may also be affecting enrollment.

The shortage of qualified math teachers is a well-known issue (https://www.bgdailynews.com/news/wku-working-to-address-teacher-shortage/article_d61da508-0361-54d6-a8d5-194eae4eb305.html). This major contributed 5 of the 6 math teachers graduated from WKU in Fall 2018 (referenced in the article).

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	5	60.0	4	75	4	100	2	50	4	75	69.4%
Progression			54	77.8	57	78.9	48	75	41	70.7	61.3
150% Graduation Rate	0	0	2	50	4	100	7	71.4	5	60	54.1
Time to Degree	3.50		4.72		3.45		3.69		4.81		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

- Graduates will communicate mathematics effectively in both written and oral forms.
  - Means of assessment: This is assessed in MATH 302, 304, 403, 411, 413, and 490 via homework, exams, finals, papers*, classroom discussions/discussion boards, and presentations*. (* are specific to MATH 490.)
- Students will learn application of mathematics in solving real world problems and will demonstrate their capacity to use multiple strategies and appropriate technology to apply mathematics in problem-solving situations.
  - Means of assessment: This is assessed in MATH 302, 304, 403, 411, 413, and 490 via homework, exams, finals, papers, and presentations (MATH 490).
- Students will be able to use mathematics as a tool for decision making.
  - Means of assessment: Success (80% or better) in the MATH 490 capstone course.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

We recently implemented an end-of-program survey for our graduates to complete. Although we do not have sufficient data from this survey yet, we anticipate that data from this survey will impact the program positively by identifying areas for improvement and areas of success. Most of our graduates take positions locally in middle schools and high schools. Many have positions before they graduate. Local administrators and colleagues at GRREC often email us asking for graduates to apply to positions as they open.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Several faculty work with Green River Regional Educational Cooperative as consultants and regularly with School of Teacher Education faculty. Through these relationships, we can discuss with stakeholders (STE faculty, local administrators, and local teachers) opportunities for improvement and areas of success.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

As mathematics teachers are regularly in high demand, we often receive emails from administrators or contacts at GRREC soliciting graduates for positions. Some of our students secure jobs before graduation and nearly all of our students have found employment after graduation. Additionally, we've recently made changes to the curriculum used in two of our courses (MATH 205 & 308) to improve the rigor of the courses, and we've created a new course (MATH 302) to strengthen students' knowledge of mathematical proof.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					28	12
Number of NTE Faculty					12	4
Cost per SCH					120	128
SCHP/FTF by Dept.	469	516	508	446	438	375
% SCH by FTF by Dept.	83.7	84.8	88.2	87.7	89.0	75.8
Median Class Size by Level	12	16	16	14	11	19
% Under-Enrolled Sections by Level	58.2	46.9	46.9	50.7	64.9	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

There is extra DELO revenue generated by MATH 403, MATH 411, and MATH 413.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The 730 program hosts a diverse body of students (p. 6), with students from all over the world. The large majority of these students complete the program and go on to be successful (p. 7) in getting a teaching position. Our 730 graduates are prepared for the global stage (p. 7) after completing their coursework. We feel that the 730 program has contributed to WKU's goal of global learning (p. 15), by providing a student population from around the world.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The diverse backgrounds of our 730 students (mentioned above) and our program faculty address Objective 1. The high and timely completion rate of the students in the 730 program addresses Objective 6. Our highly effective graduate faculty, one of which has won the college's teaching award, address Objective 8. The research and grant productivity of those faculty addresses Objective 10.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The Kentucky Future Skills Report seems to be heavily focused on engineering, manufacturing, and health-care related jobs. Nearly all of our 730 graduates will become middle school teachers. So, please remember that, while engineers make bridges and cool gadgets and doctors make people better, teachers make engineers and doctors.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

This program is part of the SKyTeach model. As such, students get early experiences in the classroom that is not typical of all education programs in other universities. Courses for 730 majors come in a variety of formats (face-to-face, online, IVS) to make the major accessible to students at regional campuses. As mentioned earlier, we often receive emails soliciting graduates from this major for positions.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The existence of undergraduate majors in our department has enabled us to attract and retain an extremely high quality of tenure-track faculty over the past decades (3 UDP's, 1 university research award winner, perennial "favorite teachers", several junior faculty that are thriving). These teachers provide instruction to many other majors in Ogden College (engineering, physics, etc.), and they would not have even applied to work at WKU if we did not have undergraduate majors. I do not see that reality addressed anywhere else in this comprehensive assessment.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

About half of our recruiting for the 730 major takes place in our entry-level and upper-level classes (MATH 205, MATH 206, MATH 308. The other half show up at WKU ready to major in middle-grades mathematics. We have a team of 2-3 Math Ambassadors that attend Head for the Hill events, and used to attend recruiting events set up by the Office of Admissions, but individual departments are no longer invited to these events, so our off-campus recruiting is largely at the mercy of Admissions personnel.

We still work very hard to retain students in the 730 program, and will continue to do so. The program has been streamlined so that students in the teacher certification track of the 728 major can more easily add the 730 major.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The number of bachelorette degrees in math and stats has risen slowly over the last five years, although the total WKU enrollment has gone down.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Two changes have been made recently to this major. First, we have introduced MATH 302 (prerequisite for 304, 403, 411, 413, and 490). This was a result of seeing students not being prepared to engage in higher level mathematics – not able to justify arguments, prove conjectures, or communicate effectively with regards to mathematics. This ensures students are more prepared for the upper division courses and will be more successful as mathematics teachers. Second, we changed the curriculum in MATH 205 and 308 to be more rigorous. We are currently collecting data on the effectiveness of this. Preliminary data demonstrates that students who take MATH 205 with this new curriculum are more successful in completing MATH 308 than those who do not (i.e., those receive MATH 205 as transfer credit or took it under the old curriculum).

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

We would like to see the program continue at its current strength, if not a bit higher enrolled. It is not a great time of encouragement right now for students to pick a teaching career, with the controversy that has surrounded the funding of public school teachers' pension program, but while that is out of our control, we are hopeful that progress with be made in funding for teachers' pensions and salaries.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Dean's Office
College:	Ogden College of Science and Engineering

Program Name:	Middle School Science
Reference Number:	734
CIP Code:	400101
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	120
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Middle School Science major (734) is not an independent major. For a student to declare a 734 major they must also declare a Science and Math Education major (774) under the SKyTeach program.

Additionally, all required and support coursework for the 734 major is housed in other academic departments in Ogden or CEBS: Astronomy & Physics, Biology, Chemistry, Geography & Geology, Mathematics and the School of Teacher Education. The 734 major is constructed from coursework already taught by the other academic departments.

The mission of the middle school science program (MSS) is aligned to the UTeach replication goals of attracting a wide range of bright science and mathematics majors into middle school teaching careers, preparing them through an advanced field-intensive curriculum, and promoting professional retention through induction support and ongoing professional development. The MSS is aligned with WKU's mission through the recruitment of high quality candidates for teacher preparation in science to improve science education in Kentucky. The program also offers mentoring and induction support post-graduation and provides support to local teachers by promoting science outreach.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	35	30	29	22	16	89
Conferrals	12	4	8	5	4	22
SCHP	NA*	NA	NA	NA	NA	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The quality and preparedness of the students coming to WKU is a direct result of training and placing highly qualified teachers in P-12 classrooms across the Commonwealth. The 734 MSS program provides WKU pre-service teachers with a solid foundation in content knowledge across the five sub disciplines: astronomy, biology, chemistry, geology and physics found in the Next Generation Science Standards. The better prepared our STEM discipline teacher are, the more effective they will be in the classroom.

*No data was supplied from Academic Affairs. All required and support coursework for the 734 major is housed in other academic departments in Ogden or CEBS: Astronomy & Physics, Biology, Chemistry, Geography & Geology, Mathematics and the School of Teacher Education.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Producing highly qualified middle school science teachers directly supports state policy objective 3 (increase the effectiveness of Kentucky's K-12 teachers) and indirectly policy objective 1 (increase the number of college-ready Kentuckians entering postsecondary education) as found in the Kentucky CPE Stronger by Degrees document. Students in the MSS program take coursework in five content areas (biology, chemistry, geology, astronomy and physics) therefore giving them a breadth and depth of content knowledge. SMED programs rigorously train students in the 5E inquiry model of science/math instruction which has been shown to improve student understanding of science/math concepts over traditional lecture-based methods.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	0	0	2	100.0%	2	50.0%	0	0	1	100.0%	69.4%
Progression			19	73.7%	24	62.5%	16	87.5%	7	85.7%	61.3%
150% Graduation Rate	0	0	0	0	3	66.7%	2	50.0%	0	0	54.1%
Time to Degree	2.79 (N=11)		3.92 (N=4)		4.59 (N=8)		8.20 (N=5)		4.33 (N=3)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

SKyTeach students must meet key assessment benchmarks in order to demonstrate proficiency at critical junctures in their teacher preparation program. These Key Assessments (KA) are aligned with Kentucky Teacher Standards and guidelines for courses as outlined by the UTeach Institute. Students demonstrate their mastery of content knowledge throughout the program by developing and delivering content specific lessons during teaches.

Key assessments are outlined as follows:
SMED 310 KA #1-By completing the Final Project: Lesson Plan, students in SMED 310 will demonstrate their abilities to create an effective and engaging math and/or science lesson for students at the middle grades level using their content knowledge, pedagogical content knowledge, general pedagogical knowledge, and knowledge of learners and learning. This critical performance is an evaluation of Kentucky Teacher Standards 1, 2, 4, and 5.
SMED 320 KA#1-By completing the Video Analysis Project, students in SMED 320 will generate a lesson plan, 30 minute video of teaching and video reflection paper.
SMED 340 KA#1-By completing the historical research project, students in SMED 340 will complete this critical performance as part of a team of between 3-5 students. Each team will research and design a 3-day sequence of lessons using an historical perspective to improve the teaching of a mathematics or science topic.
SMED 470 KA#1-By completing the project-based unit of instruction, students in SMED 470 will develop a three to four week project-based unit plan of instruction for middle and/or high school students in science or mathematics and a twelve to fifteen minute presentation on the project-based unit plan.
SMED 489 KA#1- By completing the Teacher Work Sample (TWS), students in SMED 489 will complete a performance-based assessment tool for teacher candidates to demonstrate ability to plan, deliver, and assess a standards-based instructional sequence, analyze student learning, and reflect on teacher candidate's instruction and student learning to improve teaching practice. WKU teacher candidates are required to plan a unit of study between 5-10 days in length.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The capstone experience in the MSS program includes a semester of student teaching internship which includes a 15 week supervised experience in a local area school with an option for 5 weeks of the experience to occur in an international school setting. The supervisory team includes the cooperating teach in the internship, a university supervisor external to the SKyTeach program and a SKyTeach program faculty member who instructs the student teaching seminar course. The student teaching seminar course includes a critical performance of a teacher work sample. All graduates of the MSS program have successfully completed the student teaching internship program and accompanying seminar course. Upon graduation, program graduates complete the Kentucky Teacher Internship Program (KTIP) during their first full year of employment as teachers. The KTIP evaluation team is composed of a committee that includes the school principal, a mentor teacher, and a university supervisor. The committee observes and evaluates the candidate 9 times over the course of an academic year and conducts meetings with the candidate to discuss their professional development during the KTIP year. All graduates of the MSS program who have entered the KTIP program have successfully completed their internships. This is a clear indication of employer satisfaction since each KTIP committee is led by the school principal.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The UTeach Institute surveys program graduates on an annual basis. WKU's membership in the UTeach STEM Educators Association (USEA) enables access to survey data. During the last reporting period (2018) of SKyTeach graduates, when students were asked how well their content courses prepared them for the intellectual demands of teaching, 21% (n=3) reported, extremely well, 57% (n=8) reported, very well, and 21% (n=3) reported, adequately, no respondents reported that they were prepared poorly or not at all. When students were asked overall, how satisfied are you with the SKyTeach program, 38% (n=5) were very satisfied, 31% (n=4), were satisfied, 23% (n=3) were satisfied, and 8% (n=1), were very unsatisfied. When MSS graduates were specifically asked about how the MSS program could be improved; they unanimously indicated that content courses should have a greater emphasis on the Next Generation Science Standards.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

The SKyTeach program graduates with a MSS major have a 94% rate of employment within one year of graduation. Graduates are tracked through the efforts of the program coordinator and records maintained through the Kentucky Teacher Internship Program. Further, the SKyTeach program was recognized in 2017 by the UTeach Institute as having produced the most STEM teacher graduates of any UTeach replication program in the county (n=243). 734 Middle School Science majors have a 100% pass rate on the state mandated PRAXIS content and professional teaching and learning examinations.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty	NA*					
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

*No data was supplied from Academic Affairs. All required and support coursework for the 734 major is housed in other academic departments in Ogden or CEBS: Astronomy & Physics, Biology, Chemistry, Geography & Geology, Mathematics and the School of Teacher Education.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

All grants that the SKyTeach program has been awarded have involved student participation. Grants over the past 5 years include:
NSF Career Grant: Arctic Songbirds
EPSCOR Solar Science Grant
Math Science Partnership Grant
Department of Education Teacher Quality Partnership Grant

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The SKyTeach program has a rich history of fostering relationships within local area school districts. This specifically involves pre-service teacher placements for clinical experiences and relationships with principals and superintendents for the purpose of creating pipelines for teacher job placements in STEM areas. (Our Students G2, S4)
Each SKyTeach students has a curriculum contract outlining all specific course degree requirements and all teacher certification requirements. Additionally, each student meets with a content advisor and a science mathematics education advisor each semester to guide their progression towards their degrees and teacher certification. (Our Students G2, S4)
The SKyTeach program maintains a dedicated workroom and supply room for our students to use for the purpose of developing STEM lessons. Staff are on hand to assist students with lesson development and lesson delivery. (Our Students G5, S13)

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The SKyTeach program specifically addresses items in the 2016-2021 Strategic Agenda for Postsecondary and Adult Education. Objective 2 is addressed through our work in teacher preparation increasing the effectiveness and diversity of P-12 educators by providing high quality professional development (grant initiatives). Objective 8 is addressed through the use of authentic assessments (clinical model) to evaluate student learning. Objective 9 is addressed through "work and learn" opportunities in our clinical preparation and advancement of Kentucky's STEM agenda by training highly qualified STEM teachers.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

According to data provided by the United States Department of Education in 2016-2017, Mathematics and Science content areas are teacher shortage areas in the state of Kentucky. The SKyTeach program directly addresses teacher shortage needs in the STEM disciplines.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The SKyTeach Middle School Science program is the only program of its kind in the state of Kentucky. The program is clinical field experience forward and requires 230 clinical practice hours in K-12 schools prior to student teaching. The MSS program students must be dually enrolled in the SMED program during matriculation. The dual major was created as part of the UTeach replication program in 2009. This ensures a teacher preparation program that trains teachers with a high level of content expertise in science and pedagogical expertise in professional education. Students are prepared by a professor and master teacher who co-teach the professional education (SMED) courses. This ensures that the middle school science content is correctly implemented in clinical practice which occurs in field experiences that are incorporated within each SMED course.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

SKyTeach is part of a national consortium of UTeach replication sites that are 46 universities strong. This consortium is committed to high quality STEM teacher preparation and to advancing the national agenda of "Science for All" citizens and the 100Kin10 national agenda of training 100,000 excellent STEM teachers by 2021. Https://100kin10.org/

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

The program should consider adding advanced teacher preparation that includes microcredentialing in computer science and engineering to support new initiatives in the Next Generation Science Standards and National Council of Teachers of Mathematics standards. Additionally, advanced teacher preparation in problem-based learning and place-based learning could create niche markets that would further exposed our strengths in STEM teacher preparation at a national level. Also, maintaining an online repository of high quality, inquiry based STEM lessons on the SKyTeach website would further solidify the program as a respected source of STEM teaching tools.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

SKyTeach is part of a national consortium of UTeach replication sites that are 46 universities strong. This consortium is committed to high quality STEM teacher preparation and to advancing the national agenda of "Science for All" citizens and the 100Kin10 national agenda of training 100,000 excellent STEM teachers by 2021. Https://100kin10.org/

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

The program underwent an extensive program review in 2016. Changes were implement in 2017 based on program review findings. Significant changes were a reduction of hours from 47 to 30 in the middle school science program to bring the number of required content hours more in line with other university majors at WKU and across with Commonwealth. Additionally, the program revised clinical field hour requirements to comply with and exceed EPSB mandated requirements of a minimum of 200 field hours prior to student teaching.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The reduction of content hours in the middle school science program should assist the program in attracting more students to the major. This should increase enrollment over the next 5-10 years. While a strong administrative partnership exists between the colleges (OCSE and CEBS) that house the program, the SKyTeach program needs a formal budget structure within the university. Currently funds are allocated on a year-to-year basis and the levels fluctuate depending upon available funds within the respective Dean's budgets. This creates difficulty with strategic planning, recruitment, development of promotional materials, travel to national meetings related to our program and general operations.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Physics and Astronomy
College:	OCSE

Program Name:	Physics
Reference Number:	754
CIP Code:	400801
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	35
List Concentrations (if any):	General Physics, Applied Physics, Physics and Astronomy, Teacher Certification

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The major in physics requires a minimum of 35 semester hours and leads to a Bachelor of Science degree. A minor or second major is required. The course sequence is designed to provide students a solid foundation in basic Physics and a choice of upper division electives which can be tailored to match the students' interests and career goals. There are pathways designed for students who choose to pursue careers as physicists in government or industrial laboratories, for careers in engineering and other professional fields, for teaching in public schools, or for entering graduate programs in Physics, Astronomy, Astrophysics, Space Science, or related disciplines (e.g., Medical Physics). Our internationally-recognized faculty and state-of-the-art research facilities allow us to provide opportunities for students to engage in hands-on research experiences where they apply and extend their classroom knowledge by working on real-world problems.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	45	39	32	28	30	89
Conferrals	6	7	6	4	4	22
SCHP	364	328	242	217	272	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

Contribution to other programs:
Four of the core courses for the Physics major (Physics 255, 256, 265, 266) are required for Engineering, Chemistry, and Meteorology majors, and all Gatton Academy students are required take PHYS 255, typically in their second year.

Contribution to the mission of Ogden College of Science and Engineering:
Through the active engagement of Physics majors in mentored research experiences, a challenging core curriculum, and active service-oriented student organizations (the Society of Physics Students and the Hilltopper Astronomy Club), we are a key element in Ogden College's mission of "empowering individuals to become leaders though academic achievement, global connections and engagement in research education and service."

Contribution to the mission of the Department of Physics and Astronomy:
The physics major is the cornerstone program of the department; our mission of "fostering a diverse international community of faculty, staff and students through engaged learning and significant research, stimulating intellectual curiosity and critical thinking."

We aim to:

1. Suitably prepare the next generation of scientists, engineers and health professionals;
2. Increase understanding of the physical universe in the local community and beyond; and
3. Conduct research that both enables these aims and has positive impact in the local and regional community and beyond."

These goals are met through our rigorous curriculum which is infused with research-based teaching pedagogy and High Impact Practices, and through the involvement of all majors in student-centered applied research activities.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

The major in physics requires students to have an extensive knowledge of Calculus (up to and including differential equations, with a grade of C or better in all Math classes). This requirement limits the pool of students who are able to enroll in the major, and helps ensure a relatively high retention rate in the program.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	10	70.0%	9	100.0%	4	75.0%	8	75.0%	7	57.1%	69.4
Progression			26	61.5%	25	52.0%	21	71.4%	22	45.5%	61.3
150% Graduation Rate	10	60.0%	14	50.0%	13	53.8%	7	28.6%	10	40.0%	54.1
Time to Degree	4.28 (N=6)		4.72 (N=6)		3.67 (N=6)		3.67 (N=4)		5.00 (N=4)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Program Student Learning Outcomes: (as defined in the Department SACSSCOC Compliance Report and approved by the Office of Academic Affairs).

- Students will develop a mastery of several empirical methods.
    1. Students will demonstrate a successful use of critical laboratory methods required for empirical methods. This is tested via performance on constructing and presenting research results as part of their mentored research experiences and/or through required research presentations for students completing PHYS 398 (Junior Seminar) and 498 (Senior Seminar).
- Students will show a mastery of foundational principles and requisite mathematics.
    1. Measured via an analysis of scores and sub scores on the Major field Test (MFT). Our goal is to have the students score at above national medians.
    2. Measured via tracking of the pre- and post- Force Concept Motion Evaluation (FCME) scores. Our target is 20% or greater gains on the FCME.

The FCME is a multiple-choice test on basic concepts of force and motion; it is administered twice: once at the beginning of the PHYS 255 course in order to define the level of understanding upon entry, and again at the end, in order to assess the increase in understanding that has resulted from the PHYS 255/256 course/laboratory sequence. We are only now becoming comfortable with the amount of FCME data obtained, and have begun to analyze and make an assessment of student learning based on it. The physics lab coordinator routinely works with the laboratory instructors using lab reports and laboratory final exams to identify areas in which the students are not demonstrating successful use of critical laboratory skills. A recent closing-the-loop assessment example is a shift in the increased emphasis of submitted lab reports to include a deeper focus on areas such as data presentation and analysis; although performance in these areas had been weak, new experiments specifically focused on these aspects were introduced, and a significant improvement in student skills in this area, as reported by instructors who routinely teach, resulted.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Program graduates are surveyed and the department maintains a database of students who have graduated and where they have gone (employment/employer, graduate school, etc.). Most of our students either continue onto graduate school, or secure employment in STEM-related industries or as

STEM K-12 educators. Utilizing informal alumni feedback, we continually work to ensure the curriculum prepares students for graduate school or employment.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

We have no formal mechanism to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills. However, program faculty are active in their professional societies which provide institutions data on employer needs and skill requirements, and the program responds to that data as appropriate. One example is an increasing demand for physics students to be competent in programming languages typically used in the field (LABVIEW and Python in particular). As a result, we have recently added a Python programming element in our introductory Physics sequence. Also, in our recently revised course cadence (see item 6c below) we have ensured regular offerings of PHYS 316 (Computational Physics) and PHYS 318 (Data Acquisition using LabVIEW) classes. Students who successfully complete the LabVIEW class are eligible to become certified as LabVIEW associate developers by National Instruments Inc.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

Several students in the program have recently advanced to graduate school opportunities at prestigious institutions such as Harvard University, the University of Tokyo, Japan, Lousiana State University and Duke University. Recent graduates have also secured employment in STEM companies such as Advanced Technology Development Scientific in Huntsville, Al., HeathCo LLC, Schneider Electric and Oak Ridge National Laboratory. Historically our students who choose to advance their knowledge through graduate study attend some of the top programs in Physics or Astronomy in the country.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					11	12
Number of NTE Faculty					4	4
Cost per SCH					158	128
Cost per SCH-program					1730.6	128
SCHP/FTF by Dept.	410	361	375	368	372	375
% SCH by FTF by Dept.	91.8%	87.6%	87.7%	88.3%	92.0%	75.8
Median Class Size by Level	7	7	7	5	7	19
% Under-Enrolled Sections by Level	85.7%	83.3%	82.6%	76.0%	79.2%	36.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Department faculty members generated individual amounts between $50K and $350K per year in grant funding over the course of the evaluation period; much of this funding came from peer-reviewed proposals at the Federal level (e.g., NASA, NSF). Over the course of the evaluation period, the department averaged 1.5 FTE per year in academic year buyout. The majority of students who have participated in mentored applied research activities received funding from, and were advised by faculty who were Principal Investigators on, these external awards.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The program cost/SCH is calculated for the combined physics major and minor, since there is 100% overlap in courses between the major and minor (i.e., no courses are taught specifically for the minor). In order to properly take into consideration the presence of two former administrators on the faculty, we have calculated the cost/SCH using the median, rather than the mean, department salary. The cost/SCH for the department is $186 using mean salaries and the cost per SCH for this program would be $2056 using mean salaries.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The Physics major directly addresses the following elements of WKU's strategic plan:

Our Students: Preparation for the Global Stage-

Through the Colonnade Program, a student's degree program, and the Personal and Professional Development Plan, provide common intellectual experiences and high-impact practices to develop hard and soft skills as well as to cultivate good, productive citizens.

Our Hill:

A culture of Innovation Review current teaching methodologies, integrate appropriate best practices, support the requisite physical structures and technologies, provide ongoing training for faculty in pedagogy, and include evaluation of instruction in tenure and promotion reviews.

Facilitate high impact practices, immersive learning in different cultures, process-learning practices, and collaborative learning and instructional opportunities.

The above aspects of WKU's strategic plan are addressed by program faculty who remain abreast of, hold leadership roles in the development of, and implement current research-based teaching methodologies and high impact practices in the program courses. As part of the partial renovation of TCCW we expanded the capacity of two active learning classrooms for use in program classes.

Our community and beyond:

A regional Lighthouse Ensure that WKU students graduate with skills to think critically, solve problems, and engage effectively with others.

The above aspect of the strategic plan is addressed both through program coursework, which stresses critical thinking and problem solving from the introductory courses onward, and as part of the mentored research experiences in which each student is expected to participate.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The major in physics has contributed to the economic and social welfare goals of HB1 as delineated in the statewide postsecondary strategic agenda by addressing policy objectives 4 within the focus area of student success and policy objective 6 in Research, Economic, & Community Development. Objective 4 was addressed via program initiatives to align the curriculum with current best practices in Physics and Astronomy education. Objective 6 is addressed by the continued program faculty efforts and success at securing extramural funding for both basic and applied research.

The major in Physics is aligned with the statewide strategic implementation plan by addressing Objective 8, strategy 8.1, through program initiatives to align curriculum with current best practices in Physics and Astronomy education.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

According to the February 2018 report from the Kentucky Workforce Innovation Board, "Kentucky Work Ready," there is a critical need in Kentucky for a work force that can be successful in middle-skills jobs. The role of postsecondary education is to provide augmented skills that add value to this workforce. Critical thinking is a skill that employers demand of workers at all levels and which they routinely note is generally lacking, particularly in students who enter the workforce with no post-secondary experience. The major in physics is emphatically *not* a jobs training program; it is a major that emphasizes and

considerably strengthens the student's critical thinking and technical skills, thus adding value to the student's overall education experience and preparing them for success in a world in which critical problem-solving plays an ever-increasing role.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The department fully embraces active learning (also known as interactive engagement) in its introductory classes for the Physics major. Extensive research over the past 20 years shows that effective physics instruction should be designed around the philosophy of "Tell me and I forget. Teach me and I remember. Involve me and I learn." This is an instructional methodology that moves away from a model in which the professor lectures to the students for the entire class period, towards a model in which the students and the professor work together during the class period to explore and learn physics concepts. IE has been long shown to be an effective method for teaching Physics to university level students. In 2003, the Physics and Astronomy department, through the use of Provost Initiative Enhancement (PIE) Grants, created the first interactive engagement classrooms on campus. A few years later, a second such classroom, also funded via the PIE initiative, was opened. When TCCW re-opens in 2019, these two classrooms will have been expanded to increase their capacity by 50% to accommodate the very substantial growth in demand for our calculus based introductory physics classes. WKU's CTIL has embraced this as a high impact practice.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

The Physics major is a staple of science colleges within universities nationwide. There are a total of 759 Physics departments nationally that grant an undergraduate degree in Physics; in Kentucky, every state university grants a Physics degree. Although enrollment is perhaps not as high as in other majors at WKU, the program enrollment and graduation numbers compare very favorably to similar programs in Kentucky and indeed nationwide. Physics is the foundational science; all hard sciences (and many of the soft sciences) require a strong foundation in physics principles and in the problem-solving skills that epitomize physics programs. We have endeavored over the years to consistently maintain an appropriately high degree of rigor in the curriculum and in prerequisites for enrollment. Although this has restricted enrollment somewhat, those students who do participate enjoy a challenging educational experience that is second to none, working with and learning from a team of faculty who, as evidenced by their success in the world of teaching and research, have earned the respect of their peers.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

Admission to medical school is very competitive, and the reality is that many pre-medical students will not be admitted. The department is considering the development of "bridge" courses that would allow these students to transition from the algebra-based curriculum of the pre-med program to a calculus-

based curriculum that leads to a physics degree and eventual employment in other areas within the medical profession.

The department is also exploring the development of dual baccalaureate/masters programs, similar to the JUMP program at WKU, but connecting with other universities with relevant majors, e.g., astronomy and materials science. In such programs, students would complete core courses at WKU and then transfer, via established Memoranda of Understanding, to a masters program at another institution. Courses taken toward that masters degree would then, under the terms of the Memoranda of Understanding, transfer back to the WKU baccalaureate curriculum, allowing the student to earn that degree.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

According to the American Physical Society, nationally the number of students graduating with a physics major has been increasing for the last 20 years. That trend is, unfortunately, not reflected in physics major programs at any university in Kentucky. Nevertheless, the national trends suggest a continued growing interest in Physics among undergraduate students nationally. It will take a significant effort at recruiting students from outside the state of Kentucky into the Physics major to capitalize on this growing national interest of undergraduate students in physics.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

In the past three years, the department has worked on scheduling the introductory courses in a manner that maximizes (within the constraints of our available teaching capacity) availability of these courses to our students. This included regularly offering sections over the summer to keep students on track to graduate.

Last year, in response to the recommendations of a department ad hoc committee, the program faculty undertook a comprehensive study of the frequency of offerings of our 300- and 400-level program courses. Our goal was to restructure the schedule of upper-level courses in order to offer them on a schedule and cadence that maximized course enrollments while avoiding any adverse impact on student progression. The results of this action were a comprehensive overhaul of the scheduling for the Physics major, in which most 300- and 400-level program courses are now offered either only once a year (instead of each semester) or even once every other year (instead of once per year), within a schedule and set of course contents/prerequisites that allows students the necessary flexibility as to the order in which the core courses are taken. All upper division courses are now offered on a regular rotation to ensure predictable availability to students, while optimizing the department's teaching capacity. The result of this action is that enrollment in these courses should approximately double, providing a more efficient use of classroom contact time, while still allowing students to complete program requirements in four years. Early indications are that the desired outcome is indeed being achieved, with higher enrollments already evident in core courses (e.g., 11 in PHYS 350 (Classical Mechanics) this Fall).

Starting in 2016, the department instituted recitation sections for students deemed, on the basis of early test results, to be at risk of not achieving a C or better in PHYS 255 and 265. (A grade of C or better

is required to move on to the Physics major or to upper-level courses in other majors, such as Engineering.) Students who do not achieve a passing grade on the first test (given prior to the 5th week assessment) are assigned to a recitation section for additional assistance in Physics problem solving strategies, at no additional cost to the student. These sections are offered during one 80-minute time slot each week, chosen to be the "mirror" of one of the time slots for the 4-semester-hour main class (e.g., Tuesday 8:00-9:20 for the class, Thursday 8:00-9:20 for the recitation section), to guarantee that a student is not prevented from attending a recitation section by schedule conflicts. In order to expose the students to different approaches and insights, each recitation section is staffed by an instructor different from that of the main course section; the instructors coordinate activities through informal discussions throughout the semester. Early anecdotal evidence indicates that students who participate in these sessions do improve their performance, and there is now sufficient data to begin a formal assessment of the impact of these recitation sections.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Given the continued increase nationally in Physics majors, it is reasonable to assume the program could undergo significant growth in the next 5 to 10 years. The number of applicants to the program, who have almost exclusively come from within Kentucky, has remained constant over the past three years. To increase the applicant pool will require a sustained, concerted recruitment effort, including significant efforts at recruiting students from outside Kentucky and significant assistance from the Office of Admissions.

Experience in, and publications from, mentored applied research experiences have become the norm for students going to graduate programs as well as into employment. These research experiences demonstrate to graduate schools and employers that the students can apply their knowledge to real world problems and effectively communicate their results and experiences. Our program is at the forefront of such efforts, and, fueled by our continued success in securing external funding for our research endeavors, we will continue to bolster this aspect of our program. Many upper-level undergraduate courses already contain an element of research-level problem solving, and an ongoing assessment of these activities indicate that they are not only well-received by students, but also contribute meaningfully to their critical problem-solving skills.

Recruitment of research-active faculty is also a critical need going forward. The department has experienced unreplaced faculty losses over the past 10 years, and our faculty are now aging – by next year we will have no assistant professors and all tenure-eligible faculty will be tenured. While we are fortunate to have active researchers among all ranks of our faculty, we are not in a long term sustainable position.

e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☒ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Psychological Sciences
College:	Ogden College

Program Name:	Psychological Science
Reference Number:	747 and 747E (**programs differ only in number of hours)**
CIP Code:	42.2799
Degree Type (AB, BS, etc.):	BS
STEM+H Degree (Y/N)	NSF definition: Yes, KY-CPE definition: No
Minimum Hours Required:	38 (#747) or 50 (#747E)
List Concentrations (if any):	Applied Psychological Science, Biobehavioral Psychology, Clinical Psychological Science, Cognitive Psychology, Developmental Science, General Psychology, Social Psychology, and Quantitative Psychology

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The program is designed for students interested in a scientifically-grounded psychology major that will prepare them for careers requiring strong quantitative and research skills or for graduate study. Delivery is primarily in-person with selected courses offered online. We meet American Psychological Association (APA) guidelines for undergraduate psychology programs to ensure that students build knowledge in critical domains. A second major, minor, or certificate is required for the 38-hour option (747), but not for the 50-hour option (747E). Outside the department, students must complete MATH 183, 116/117, or 136. Admission is not selective, but progress through the program is contingent on prerequisite course success. Students complete core coursework, concentration-specific courses, and at least two laboratory courses that provide hands-on experience in the discipline. The core consists of courses covering the discipline-specific knowledge outlined by the APA Council on Accreditation as fundamental for further training. Students complete concentration-specific courses to receive advanced theory and methods training in one or more sub-disciplines consistent with their planned career or graduate training. Over half of graduating students have completed research training in basic science or applied projects through independent study.

Programs 747 and 747E differ only in number of hours and are combined in this document.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	NA	78	133	160	189	89
Conferrals	NA	16	17	29	35	22
SCHP	NA	830	1266	1595	1945	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

Psychological Science (PSYS) coursework supports at least **30 other major, minor, and pre-professional programs** including disciplines as diverse as Criminology, Sexuality Studies, Marketing, Non-profit Administration, Organizational Leadership, Pre-Med, Dental Hygiene, Hospitality Management, Gerontology, Communication Disorders and Nursing.

PSYS coursework is also critical for students completing the BA in Psychology from CEBS. Graduates of the BA in AY 2017-18 satisfied over 30% of their major requirements with PSYS coursework. Psychology BA students rely heavily on PSYS courses for discipline-specific knowledge in foundational areas such as behavioral neuroscience, perception, developmental psychology, and personality theory.

PSYS courses are also important to the Colonnade program, with offerings in Explorations and Connections categories. **During the 2017-18 academic year, over 1500 students met Colonnade requirements using PSYS program coursework.**

Within the department, **PSYS major coursework is central to the Psychological Science and Neuroscience minors**. In addition, qualified students are eligible to complete the JUMP program, which links graduate coursework and research training with the undergraduate major. JUMP admission is selective. Eight students have earned the JUMP-MS degree since the first cohort was admitted in Spring 2015. These students have been admitted to medical schools, doctoral programs, or have pursued careers as research scientists.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Our program has been highly productive, especially considering its recent creation in April 2014. The first freshman cohort entered in Fall 2015, so our "conferrals" thus far largely represent students who transferred from other majors or added PSYS as a second major. We anticipate continued growth over the next five years.

Our location within Ogden College encourages partnerships with other STEM programs. For example, an increasing number of PSYS majors are choosing Chemistry or Biology minors or double majors. This synergy aligns our program with the APA's recommendation that psychology programs increase their scholarly and pedagogic involvement with other STEM disciplines.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	NA	NA	NA	NA	10	70	30	70	43	69.8	69.4%
Progression	NA	NA	47	87.2	91	72.5	116	61.2	140	62.1	61.3
150% Graduation Rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	54.1
Time to Degree	NA		4.21		3.51		3.62		3.93		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Student Learning Outcomes (SLOs) are assessed via performance on activities and examinations administered outside class using objective indicators of knowledge.

SLOS and Indicators

1. Develop working knowledge of psychology's content domains. Students take one course in each of the APA-recommended foundational domains.
    a. Developmental Processes
        i. Demonstrate understanding of physical, cognitive, and emotional development;
        ii. Develop appreciation for how developmental research is conducted and evaluated;
    b. Learning and Cognition
        i. Display understanding of knowledge representation and use in decision-making and problem-solving;
        ii. Recognize fundamental components of learning and memory systems;
    c. Individual Differences and Social Processes
        i. Describe basic processes and common errors in perceiving self and others;
        ii. Summarize biological, psychological, and social challenges of maladaptive functioning;
    d. Biological Bases of Behavior and Mental Processes
        i. Demonstrate proficiency in psychophysical methods in sensory and perceptual systems
        ii. Demonstrate a proficient understanding of how complex behaviors occur in the brain
2. Interpret, design, and conduct psychological research. Students complete research methods and statistics courses.
    a. Research Methods
        i. Apply basic ethical guidelines to research in psychology
        ii. Explain how theories and data interact to form empirical enquiry
    b. Statistics
        i. Describe measures of central tendency and variability when samples represent populations.
        ii. Identify and use statistical tests appropriate for different research designs
3. Apply ethical standards to evaluate psychological science and practice. Assessed via documenting student training in appropriate conduct of human subjects' research.

Our program is too new to assess a graduating cohort. However, the program has been revised based on regular assessments. We added an upper-level laboratory requirement to reinforce students' research knowledge. We also added several courses including Psychopharmacology, Judgment and Decision-Making, and Developmental Psychopathology to expand students' knowledge base in areas of disciplinary importance. Should performance fail to meet objective criteria for a given SLO, specificity in SLOs allows for corrective measures to close-the-loop and satisfy the SLO. Continuing our current practice, SLOs are periodically reviewed and updated to keep pace with disciplinary advances.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

We maintain an alumni database that currently includes 89 of our 95 graduates. The majority have pursued post-baccalaureate education:

- 46 (52%) entered masters level graduate programs
- 7 (8%) entered doctoral level graduate programs
- 3 (3%) entered medical school

A 2015 analysis from the Georgetown Center on Education and Workforce estimated that 45.3% of undergraduate psychology majors subsequently earn a graduate degree (as compared with 35.1% of overall college graduates). **Thus, our graduates are entering graduate programs at a higher rate than the typical psychology baccalaureate graduate.**

Of the 41 students not currently pursuing further education, 100% are employed, most commonly in Health Care and Social Assistance (34.0%), in Professional, Scientific and Technical Services (20%), and in Retail/Trade (17%).

According to the most recent National Center for Education Statistics data, employment prospects for baccalaureate psychology graduates are excellent: The unemployment rate for 25-29-year-old psychology baccalaureates was 2.9% in 2016. Although employment is spread over a large number of occupational categories, the most common fields are management, administrative support, and counseling. **Our graduates have a higher rate of employment and are more likely to be employed in Professional/Scientific fields than the average Social and Behavioral Science graduate in Kentucky (KCEWS Report).**

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

Because our program is new, we lack sufficient data from graduates for assessment of employability in the region. However, the APA maintains national-level resources on employment and employability of psychology graduates that we use to refine our curriculum. We focus on developing skills cited as important to employers: oral and written communication, ability to collaborate, critical thinking and research, self-management, professionalism, technological skills, sensitivity to diversity, and ethical reasoning. The Bowling Green Chamber of Commerce cites these skills as essential for the local workforce. Several recent revisions promote these skills:

Revision	Target skill
Implement PSYS 175	Self-management, professionalism, career-development
Create a quantitative psychology concentration	Enhance technological and critical reasoning
Develop PSYS 300 (writing in the discipline)	Enhance written communication skills
Addition of upper-level lab requirement	Enhance collaborative, technological, and research skills

Nearly 70% of our graduates have entered graduate or medical school. Thus, we also focus on development of the knowledge base and research skills that will ensure our graduates are competitive applicants to post-baccalaureate education. Inclusion of independent research and laboratory courses in our program not only provides demonstrable evidence of research expertise for graduate schools, but also provides evidence of the kind of independence, initiative, and creativity valued by employers.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)
According to the National Science Foundation's 2015 National Survey of College Graduates, psychology baccalaureate degree holders worked in 89 different occupational categories. The breadth and applicability of skills obtained by psychology majors is one of the advantages of a high-quality baccalaureate program. Therefore, rather than aligning our curriculum with a specific occupation, we focus on developing the kinds of skills that students can use in a variety of existing careers as well as critical thinking and learning skills necessary for new careers that are likely to emerge in the changing economy.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					14	12
Number of NTE Faculty					3	4
Cost per SCH **DEPT**					$133*	$128
Cost per SCH **747/440/434****					$228*	
SCHP/FTF by Dept.		295	371	379	431	375
% SCH by FTF by Dept.		86.1	92.6	86.6	86.3	75.8
Median Class Size by Level		21	24	21	21	19
% Under-Enrolled Sections by Level		34.8	31.1	32.6	24.1	36.3

*SCH costs are inflated due to the presence of a single outlier in faculty salaries. Use of median rather than mean salary reduces department SCH cost to $114 and program cost to $192.

**Major and minors share a largely-common set of courses and faculty and are therefore combined for cost-estimation.

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

From July 2014 through August 2018, program faculty members served as principal investigator or co-principal investigator on extramural funding awards totaling over $1.7 million. Main sources of funding include the National Science Foundation, National Institutes of Health (NIH), and the Kentucky Biomedical Research Network (KBRIN). The majority of our funding includes full indirect costs. In addition to increasing research infrastructure at the university, grant funds support faculty buyout time, student travel, graduate student assistantships and tuition waivers, and undergraduate research assistantships. Our undergraduate program and our grant success are closely connected: Completion of high-impact, fundable human subjects research is impossible without the assistance of undergraduate majors who work on grant-funded research as paid RAs or for course (independent study) credit. In turn, students gain valuable academic and professional experience and they become authors on conference presentations and on peer-reviewed publications. NIH and KBRIN grants also support initiatives promoting mental and physical health in our region. With sufficient support, we have the opportunity to grow these initiatives and secure additional grant or donor funding.

We have had three successful Spiritfunder campaigns that have supported undergraduate travel and scholarships for first time students.

We offer multiple Connections courses through DELO during winter and summer term.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

- Efficient use of teaching resources is ensured via an adaptable, data-driven course rotation that allows students to meet requirements while maintaining sufficient minimum class enrollments.
- Excluding regional campus courses, the proportion of under-enrolled courses in the department does not exceed 20%.
- PSYS program courses also support Colonnade and other programs (see 2.b.). Departmental SCH cost reflects a large service load and is therefore less than program SCH cost.
- Faculty grant buyouts are not reflected in SCH costs but reduce both program and department costs.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

1. **Incorporate high-impact practices, especially in applied research activities:** Innovative, hands-on laboratory classes in core domains are required. Independent research experiences with a faculty mentor also satisfy major requirements. These experiences provide students with critical hard and soft skills that improve retention and employability.
2. **Incentivize faculty engagement with students:** Annual performance evaluation, tenure and promotion, and merit pay guidelines all incentivize excellence in teaching, publishing with students and mentorship of student researchers.
3. **Enroll a diverse body of students.** At Fall 2017 census, 17% of our majors were underrepresented minorities, a higher percentage than WKU overall and the highest in Ogden College. Faculty members have instituted a program to improve the retention of first-generation and African-American students who are at particular risk of attrition.
4. **Use our scholarly expertise to improve the quality of life in the region.** Our majors work with faculty on externally funded grants totaling over $1 million. These translational research projects are directly addressing the kinds of challenges facing our region (e.g., a rapidly aging population, adolescent suicide and self-harm, substance abuse). Much of this funding is specifically geared toward institutions that engage undergraduates in research.

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

The most important aspects of the statewide strategic agenda addressed by this program are the **advancement of STEM learning and the enhancement of state health agendas** (e.g., 9.3, 9.6, 10.1, 10.4, 11.1, 11.2).

Psychology is recognized as a STEM discipline by the NSF and by the ICE-OPT program for foreign students. Students develop research skills working with faculty on applied research projects advancing physical and mental health. Community-based research helps increase public awareness of the value of basic and applied research.

Additional state goals:	Program activities:
1.1 Increase cultural competence	• Provide Social Psychology and Stereotyping and Prejudice in Colonnade.
1.4 Increase recruitment and retention of URM students	• Creation of first-generation scholarship program • Creation of a faculty/student diversity committee
2.5 Provide high school students with college-level general education courses	• Courses offered as dual credit for high school students
8.1 Use of assessments to evaluate student learning and provide data	• All courses have meaningful assessments prior to 5th week for early feedback. • Program level assessments are used to gauge program
9.1 Career development through early advising	• Development of degree plans and use of career inventories in PSYS 175 • Faculty mentors assigned to all majors based on student interests and goals

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

According to the Kentucky Future Skills database, the general occupational fields that psychology baccalaureate degree holders are most likely to hold (management; social science occupations, community/social service, and office/administrative support) are identified as *Growing* or *Fast Growing* with projected openings at nearly 85,000 and an average wage of $51,000. Multiple studies show that employers want to hire students who think critically, write effectively, and collaborate with others in teams. Our program directly emphasizes the development of these skills through our focus on collaborative research in lab classes and on research teams and an extensive writing requirement in research methods coursework and all upper-level classes. These experiences benefit our students' employability and directly address workforce needs in the profession.

Student preparation for post-baccalaureate study is especially important for their employment prospects. The most recent employment statistics for 2015-2030 (APA Center for Workforce Studies) indicate that the demand for graduate-level psychological scientists exceeds supply and will do so for the next two decades. Likewise, the US Bureau of Labor Statistics projects that employment of psychologists will grow 19% from 2014-2024, faster than the average for all occupations.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

In 2009, APA initiated a focused effort to recognize psychological science as a core STEM discipline. Our location in Ogden College gives the program a unique advantage to address three of APA's key recommendations:

1) **Teach psychology as a laboratory science**. We successfully developed laboratory courses in 3 of 4 core domains and require two laboratory courses for the major.
2) **Include psychological science courses among general STEM education courses**. We are the only psychology program in the state with a course in the Natural Science general education category.
3) **Increase pedagogic collaboration with other STEM disciplines.** Program coursework is used in the interdisciplinary Neuroscience minor with the goal of expanding this into a major. Pedagogic collaborations are especially meaningful for pre-professional students and students seeking rigorous post-baccalaureate training.

As recommended by the APA Science Directorate, our program changed to CIP code 42.2779, Research and Experimental Psychology. These strategies, along with our focus on undergraduate research experiences, increase our reputational quality and enhance our students' employment and graduate school acceptance rates.

We offer program coursework at each of our regional campuses. Students have been able to complete the major at the Glasgow campus.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

Four other aspects of our program make it distinctive from other psychology programs, regionally:

- **Inclusion of thematic concentrations in our program**: These concentrations help students gain further knowledge in a sub-disciplinary domain, encouraging them to make better long-term career choices.
- Our **extended (no-minor) option** offers greater in-depth study for students who intend to pursue graduate study.
- Our **JUMP program**, the only one of its kind in psychology in the state, offers an excellent option for advanced study for highly qualified students.
- Intentional investments in **student/faculty research collaboration** (external funding, independent lab experiences) bring distinction to WKU and increase student success.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

In 2017, APA identified 10 emerging trends in psychology, the first of which is the continued growth in demand for the major. Psychology is the 4th most popular undergraduate major nationwide and enrollments are surging at the masters and doctoral level. Thus, a strong educational pipeline is expected in the future.

Two other trends, particularly relevant for our program, are the increasing need for applied psychologists who understand technology and for psychologists working on social determinants of health. Four key factors position our program to take advantage of these emerging trends:
1) Our location in Ogden College provides opportunities for increased interdisciplinary collaborations (e.g., a Neuroscience major, a certificate or minor in Human Factors Psychology for Manufacturing Technology, additional program development in data analytics),
2) Research-active faculty with a history of extramural funding success who can support student research activities,
3) A successful, stable masters program that provides rich opportunities for undergraduate student mentoring and instruction,
4) Newly renovated lab space for undergraduates to engage in research.

We also have significant opportunity for growth by tapping into community colleges. Although we build on a base of foundation courses, our prerequisite sequencing is less demanding than some other STEM fields, so community college graduates can, with proper advising, complete the major in 2 years.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The proportion of students majoring in psychology surged 25-30% in the 1990's and has held steady. Our major has grown rapidly since inception, reflecting students' increasing interest in psychology as an applied science.

Because our major is less than 5 years old, we were able to create a program that incorporates the latest guidelines and recommendations from national organizations.

- Our program was specifically designed to align with version 2.0 of *APA Guidelines for the Undergraduate Psychology Major*, published in 2013.
- Although APA does not accredit undergraduate programs, we designed our core curriculum to map onto the areas of discipline-specific knowledge recognized by the APA commission on Accreditation so that our students will be well-prepared for graduate level training. Faculty expertise supports the necessary breadth of an undergraduate curriculum.
- Our focus on psychology as a STEM discipline places us at the forefront of undergraduate training. Rather than inserting a STEM focus into an existing program, we built the program on a foundation of expandable laboratory experiences.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

1. We incorporated a data-driven course rotation plan to more effectively allocate teaching resources. Restricted electives within core domains are offered on a rotating basis, allowing students to meet core requirements while maintaining efficient enrollment sizes.
2. According to a recent empirical article in *Teaching of Psychology*, success of psychology baccalaureate students is maximized when methodology and advanced courses are small and students can participate in applied research outside of class. Thus, we balance higher enrollments in lower-division and general education class with lower enrollments in classes with high-impact experiences.
3. We created a recruitment committee that has developed marketing and outreach materials.
4. We revised our departmental workload policy to better accommodate teaching of lab courses.
5. We instituted practices that make more effective use of graduate assistants for lab instruction and teaching assistance in large enrollment courses.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Over the next 5 years, we have the potential to create new interdisciplinary coursework and programming that will position students for next-generation employment or post-baccalaureate training in fields related to human factors (e.g., human-machine interaction, transportation, cybersecurity), health psychology, data analytics, and neuroscience.

A confluence of factors gives our program the potential to be the premier undergraduate psychology program in the state within the next 10 years: We have a strong record of incorporating mentored undergraduate research into the program, a performance evaluation system that incentivizes faculty to engage in research with students, a graduate program that enhances rather than marginalizes the undergraduate program, vast potential for interdisciplinary collaboration with other STEM departments, and a faculty with excellent external funding experience.

The main resource needed to achieve these goals is additional faculty lines. Our record of external funding, which includes significant faculty teaching buyout dollars, ideally should allow us to commit to additional faculty members to cover high demand teaching needs. Stability in teaching resources would, in turn, allow faculty members to seek additional long-term funding which will increase our capacity to continue providing high-impact undergraduate research experiences.

e. What recommendation would you put forward for the program (check one)?

■ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	Psychological Sciences
College:	Ogden

Program Name:	Psychology
Reference Number:	0469
CIP Code:	42.0101
Degree Type (AB, BS, etc.):	MS
STEM+H Degree (Y/N)	NSF definition: Yes; KY CPE: No
Minimum Hours Required:	36-45
List Concentrations (if any):	Psychological Sciences Industrial-Organizational Psychology

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The M.S. in Psychology is a 2-year, 36 or 45 credit hour program that prepares students to pursue careers in academic, business, or government settings, and/or to enter a doctoral program in psychology or related areas. Two concentrations are offered: Industrial/Organizational (**IO**; 45 credit hours required), and Psychological Science (**PS**; 36 credit hours required). The program comprises 18-21 hours of core courses in Research Methods, Measurement, and Statistics, Scientific Writing, Science of Behavior, Ethics, and Practicum/Internship, plus concentration-specific content. A thesis based on original research is required. Coursework is offered mainly in a face-to-face mode.

The program was approved in April, 2014. The first new and transfer students entered in Fall 2014.

The majority of admitted students are offered graduate assistantships (stipend + partial tuition). Admission caps are therefore based on the total funds available for graduate student support each year.

Minimum admission requirements include a background in psychology, an undergraduate statistics course, and a 3.0 GPA in all psychology courses. Admission is competitive and is based on undergraduate achievement and GRE verbal, quantitative reasoning and analytical writing scores. Since inception, the average undergraduate GPA was 3.6 for admitted students and the average GRE composite was 305.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	NA	38	29	23	22	19
Conferrals	NA	12	18	13	14	6
SCHP	NA	677	559	426	391	212

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The department offers a JUMP program for highly qualified students who take up to 3 graduate classes during their last undergraduate year. A total of 9 undergraduates have been admitted to this program over the last 3 years.

Statistics and independent research core courses in the graduate program support the OCSE interdisciplinary certificate in Scientific Data Analysis.

Advanced undergraduates are eligible to enroll in graduate level classes. The department offers several topical seminars that are specifically designed to enroll both graduate and academically qualified undergraduate students. Exposure to graduate level content and the opportunity to engage with graduate students provides substantial professional development benefits to undergraduate students.

Graduate students support the academic mission of the university by serving as research assistants in departmental labs, mentoring undergraduates in capstone research experiences, and by serving as teaching assistants for laboratories and lower level undergraduate courses. In addition, IO graduate students complete applied research projects for other units on campus, such as job analyses for SEAS and the Engineering Department, the WKU Staff Satisfaction Survey, and a marketing survey for Modern Languages. Because of their contributions, financial support for students is central to this model of graduate study.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

During the period of this self-study, our students produced an average of 14.5 theses per year, evenly split between the two concentrations. This represents the highest number of theses for any masters program at WKU.

Apparent enrollment and SCHP declines are inaccurate:

1. JUMP students are not counted until their second year, producing a false decline in enrollment numbers after initiation of the JUMP program.
2. Admission to the IO concentration was suspended in AY 2017 - 18 due to a temporary reduction in IO faculty. With a successful recent hire, the metrics will show an upward trend in future years.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	NA	NA	NA	NA	18	88.9	11	100	11	81.8	82.2%
Progression	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
150% Graduation Rate	NA	NA	NA	NA	NA	NA	18	83.3	11	81.8	73.3
Time to Degree	NA		2.14		1.84		1.95		1.28		2.56

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

1. Research Design, Methods, and Disciplinary Knowledge: Students will be knowledgeable about research design and methods in a subdiscipline of psychological science.
    a. Graduate faculty assess students' research presentations in a practicum course using a standard scoring rubric.
    b. Thesis committee members evaluate students' thesis proposals according to a standard scoring rubric that addresses the (1) content of the literature review, (2) adequacy of the research design and methodology, and (3) overall quality of the writing.
2. Technical Research and Writing Skills, and Independent Learning: Students will demonstrate proficiencies in technical and methodological research skills, writing skills, and the capacity for independent learning.
    a. Students author or co-author a journal article or a professional conference presentation or poster before completing the program.
    b. Thesis committee members evaluate completed theses according to a standard scoring rubric that addresses the (1) content of the literature review, (2) adequacy of the research design and methodology, (3) description and analysis of the results, (4) content of the discussion section, and (5) overall quality of the writing.
3. Admission to Doctoral or Professional School Program/Employment: Students will be successful in gaining admission to a doctoral or professional school degree program, or in obtaining employment related to their M.S. training.
    a. We track student admissions to doctoral or professional school programs and/or successful acquisition of relevant employment within one year of program completion.

Based on 2015-2016 assessment data for SLO1 and SLO2, we revised the Advanced Research Methodology core course to improve 1st year students' knowledge of research design, research methods, and technical writing skills. We also added a colloquium series for 2nd year IO students. These changes have improved our students' time to propose their thesis projects and increased the on-time thesis completion rate to 90% or better.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

The department maintains a comprehensive database of graduate/professional school acceptances and employment for our graduates. Data are collected via ongoing professional relationships between faculty mentors and former students. At present, we have data for 98% of the 57 students who have graduated from our program.

Over one-third of our graduates have been accepted into highly-ranked doctoral programs or medical school. The remaining two-thirds have gained employment in fields directly related their graduate training. Thirty-four percent are employed in the IO psychology field as personnel analysts, human resources and talent management directors, training and development specialists, and organizational consultants. Twenty-one percent are employed in positions related to the PS concentration training, i.e, in government and university research laboratories or in private industry as statisticians and research methodologists. About 10% are employed in human services or education.

Professional opportunities for our graduates are expected to grow in the coming years. The most recent employment statistics for 2015-2030 from the American Psychological Association (APA) Center for Workforce Studies indicates that the demand for graduate level psychological scientists currently exceeds supply and will continue to do so for the next two decades.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The APA and subdisciplinary professional societies gather a considerable amount of data on career trends, employability and employer needs. We use this data to maintain the relevance of our program. For example, the Society for Industrial-Organizational Psychology found that 75% of masters-level survey respondents were employed in private sector positions. Thus, the IO concentration has focused on developing professional skills that will be advantageous in those settings. In clinical psychology, individuals who work in substance abuse and with aging populations are expected to be in particularly high demand. Thus, our recent faculty hires focused on preparing students for additional training in these fields.

APA has determined that psychology degree holders will be especially marketable in the field of "big data analytics". Psychological scientists' ability to interpret data and human behavior will make them key members of industry analytics teams. In response to this need, we incorporated more research methods and statistic core courses into our program than is typical for masters level psychology programs and our graduate faculty recently contributed to the development of a graduate certificate in Scientific Data Analytics that can be completed by our students as well as other graduate students in OCSE.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

- Over 90% of our students defend their thesis and graduate from the program within 2 years.
- The strikingly low "time-to-degree" in the most recent year is due to the presence of several JUMP students: Their time in the program is counted only after they matriculate into the Graduate School in their second year.
- Across the two concentrations, a total of 18 former students are now enrolled in top graduate programs in psychology or in medical school, and a total of 36 former students have obtained employment in jobs that are relevant to their degree.

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					14	12
Number of NTE Faculty					3	4
Cost per SCH **DEPT**					$133	$128
Cost per SCH **0469**					$387	
SCHP/FTF by Dept.		295	371	379	431	375
% SCH by FTF by Dept.		86.1	92.6	86.6	86.3	75.8
Median Class Size by Level		11	7	7	7	8
% Under-Enrolled Sections by Level		42.1	70	63.2	83.3	55.3

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

Program faculty have been highly successful in acquiring external support for their research with over $1 million in funds during the self-study period.

Three faculty members obtained support from the Kentucky Biomedical Research Infrastructure Network (KBRIN) and two faculty members received National Institute of Health (NIH) funding. This funding includes full indirect costs. In addition to increasing research infrastructure at the university, these grant funds support faculty buy-out and conference travel, student conference travel, and graduate assistantships and tuition waivers. This grant success would not be possible without the assistance of graduate students who work on grant-funded research. In turn, they gain research skills, professional experience, and the opportunity to become co-authors on conference presentations and publications. These grants also support research initiatives promoting mental and physical health in our region, for example with the creation of the interdisciplinary CASHA center.

Two faculty members participated in the SpiritFunder campaign and obtained support for graduate students' thesis projects and conference travel.

IO faculty maintain relationships with organizations across the country that provide students with paid summer internships. These organizations often provide resources for students' thesis research (e.g., access to employees) as well as career opportunities for graduates.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

Courses in the program core are taken by students in both concentrations. Class sizes for discipline-specific content are restricted by concentration and managed via course rotation to ensure appropriate program pedagogy and one-on-one mentoring of student theses.

Changes in median class size by level and % under-enrolled sections reflect an intentional, temporary reduction in admission to the IO concentration. These metrics will return to previous levels in AY 18-19. The % SCH by FTF is higher than the university median and is expected to grow further in AY 18-19 with the additional IO concentration cohort.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

Enroll a diverse body of regional, national, and international students through:

- Regional, national, and international conduits for attracting students (over 50% of students come from universities outside of Kentucky).
- Ongoing relationships with faculty at Tennessee State University to recruit students from their Neuroscience Education and Research Vanderbilt Experience program.
- Funding application fees for URM students.
- Supporting applications to the Distinguished Minority Fellows program (50% of URM students received multi-year support).

Incentivize and support research and creative activities that promote student learning by:

- Including excellence in teaching, publishing with students and mentorship of student researchers in our performance evaluation system, tenure and promotion, and merit pay guidelines.
- Strategically allocating assistantship funds at benchmark levels to support student engagement in research assistantships.
- Providing financial assistance to students for travel to professional conferences.

Ensure that students graduate with skills to think critically, solve problems, and engage effectively with others by:

- Mentoring students through the process of conceptualizing research questions, designing research studies, developing and completing data collection and analysis, and communicating findings to professional peers

Use scholarly expertise to improve quality of life in the region through:

- Externally-funded research projects that directly address quality of life issues (e.g., an aging population, adolescent self-harm, substance abuse).

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

Opportunity: We increase opportunities for advanced study in a STEM field whose graduates are in high demand in the workforce by:

1. Reducing the financial burden of obtaining our degree through grant-funded assistantships and tuition support.
2. Providing financial support for application fees for URM applicants and helping them obtain Distinguished Minority Fellowships.
3. Providing opportunities for graduate students to conduct or assist in research, helping them gain employment and pursue further graduate study.

Success: We improve the academic excellence of the program and increase the career readiness and employability of graduates by:

1. Employing objective measures to assess student learning outcomes and to use data to improve the program curriculum.
2. Ensuring that our graduates are highly successful in gaining employment and pursuing further graduate study.
3. Maintaining ongoing professional relationships with our graduates to track their long-term success.

Impact: We advance Kentucky's STEM agenda and health outlook by:

1. Providing students with scientific knowledge and research and quantitative skills that are valued by employers in KY.
2. Providing training in an emerging field of employment by supporting the graduate certificate in Scientific Data Analytics.
3. Obtaining NIH funding for, and training students in, research designed to enhance the mental and physical health of Kentucky's citizens.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The most recent employment statistics for 2015-2030 from the APA Center for Workforce Studies indicate that the demand for graduate level psychological scientists currently exceeds supply and will continue to do so for the next two decades, especially in the south and southeast. Likewise, the US Bureau of Labor Statistics projected that employment of psychologists will grow 19% from 2014-2024 (with over 50% growth in IO jobs), faster than the average for all occupations. The occupations that our graduates are most likely to enter (I-O psychologist, human resource manager, social science technician, social and community service manager) are categorized as ***fast growing*** by the Kentucky Future Skills report.

Strong demand is projected for applied psychologists who can address employment issues, the human-technology interface, and for psychologists who understand the social determinants of health status. Our program successfully trains students, through coursework and research mentorship, to work in fields that address these needs as demonstrated by their employment success. Finally, although completion of our MS in Psychology alone does not qualify a student for licensure, our program provides training that increases our students' preparation and competitiveness for acceptance to doctoral programs that do enable licensure.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The PS concentration offers students a research-oriented curriculum and close mentoring by research-productive faculty. Consequently, students achieve prominence presenting research at national and international conferences. During this self-study period, all 31 PS graduates were co-authors on professional presentations, with an average of 3 presentations per person, 8 co-authored peer-reviewed articles in top journals, with 5 of these co-authoring more than 1 article, and 1 received the Student Poster Award at the Association for Cognitive and Behavior Therapies. The national prominence of our students' research has positive impacts on their acceptance to doctoral programs at major research universities and to medical school; 48% are currently pursuing further graduate study.

The IO concentration is ranked as one of the top Masters level programs in the nation. In 2018's published rankings of IO master's programs by the Society for Industrial and Organizational Psychology, our program scored in the top 10 or 20 across numerous indicators and was **#10 nationally in overall rankings.** We ranked especially highly in student perceptions of program culture, program resources, and reasonable program costs. The national reputation of the IO program is also evident in the number of out-of-state applicants and enrolled students and the employability of our graduates.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

We maintain a nationally recognized program through active recruitment activities and faculty professional involvement. We average over 50 applications each year (from an international pool) with a 40% acceptance rate and 60% yield rate. Our reputation produces a steady stream of high-quality applicants who raise the program's profile.

Student diversity is central to our mission. We have increased access for URM populations by developing relationships with faculty at historically black universities and by helping these and other URM students gain additional financial support. Seven URM students have graduated from our program; 4 are pursuing further graduate study, and 3 are employed in the discipline.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

1. Existing faculty expertise in trauma, addiction, and self-injury represents a twofold asset. These research areas are attractive to students seeking graduate training and this translational research has the potential to impact the well-being of our regional community.
2. New IO faculty will allow us to attract and train students who can address emerging trends in business and industry, including technology-based assessment, work-life balance, and occupational safety and health.
3. The focus on evidence-based mental and physical health care in ACA has increased the need for individuals with training in applied research methods and statistics. This creates opportunities for collaboration with other departments focusing on graduate training in health psychology and evaluation research.
4. With the aging population, there are opportunities to grow our interdisciplinary connections with faculty in CHHS and the School of Engineering and Applied Sciences. Development of a concentration in human factors (examining the role of human behavior in ergonomics, workplace safety, human-computer interaction) with an emphasis on aging is an emerging market where we could readily build on existing expertise. Training in this area would expand opportunities for our students into a fast-growing career field. The research products could significantly enhance the well-being of our regional population.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

In 2017, APA identified 10 emerging trends in psychology. Two trends that are particularly relevant for our program, are the increasing need for applied psychologists who understand technology and for psychologists working on social determinants of health. Our expertise in these areas represents an advantage for our students: Our focus on basic psychological processes bolstered by training in data analysis, oral and written communication skills, and use of relevant technology provides our students with the tools necessary for successful doctoral level training or employment.

In addition, national trends indicate a growing need for doctoral level psychologists. This need is reflected in the continuing demand for enrollment in our program and by our graduates' success in entering accredited doctoral programs. Moreover, psychology is unique in that graduates in this field obtain training that allows them to gain employment in a variety of sectors that show substantial job growth, including health care, education, engineering, and business. Our program is well-positioned to take advantage of these national trends.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

We adopted a new program policy in AY 2016-2017 that students must complete their thesis proposals by the end of the fall semester of the 2nd year in order to retain assistantship funding. We expect that this policy, in combination with the curriculum changes mentioned previously (i.e., additional assignments in the Advanced Research Methodology core course to improve 1st year students' knowledge of research design, research methods, and technical writing skills; new colloquium series for 2nd year IO students), will produce further improvement in on-time thesis completion and graduation rates for our students.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

Based on our review of regional and national workforce trends and assessment of graduate program offerings at other universities in KY and the region, we see clear opportunities for program growth. In five years, we can strengthen existing faculty expertise in Health Psychology, IO Psychology, and Clinical Science. Within 10 years we could build a strong program in Human Factors/Engineering Psychology that would focus on user-experience across a variety of systems and technologies. Demand for graduates in these areas is strong; however, with the exception of WKU's IO concentration, there are no master's level programs in these areas in the state.

Our program is uniquely positioned to develop and grow these areas of graduate study: We have well-established connections with employers in the field, a base of faculty expertise, strong interdisciplinary connections with CHHS and a wealth of possibilities for collaborations with other OCSE departments.

Faculty retirements present both a significant challenge and a significant opportunity in implementing this vision for our program. With careful strategic hiring growth, we will be able to replace retiring faculty members in a way that allows us to maintain fundamental, core programmatic needs and simultaneously branch out into areas with potential for disciplinary expansion.

e. What recommendation would you put forward for the program (check one)?

■ **Grow/Enhance (Significant strategic potential exists)**	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Sciences
College:	Ogden College of Science and Engineering

Program Name:	Six Sigma and Quality
Reference Number:	1729
CIP Code:	150613
Degree Type (AB, BS, etc.):	Certificate
STEM+H Degree (Y/N)	Y
Minimum Hours Required:	
List Concentrations (if any):	

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)
The unit recommends suspension of this program. Thus, no other information is provided.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students						
Conferrals						
SCHP						

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate											
Progression											
150% Graduation Rate											
Time to Degree											

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty						
Number of NTE Faculty						
Cost per SCH						
SCHP/FTF by Dept.						
% SCH by FTF by Dept.						
Median Class Size by Level						
% Under-Enrolled Sections by Level						

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)
b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)
c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)
d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)
e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)
b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)
c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)
d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)
e. What recommendation would you put forward for the program (check one)?

☐ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☒ Suspend (Teach-out may be required)

COMPREHENSIVE ACADEMIC PROGRAM EVALUATION
PROGRAM SELF-STUDY WORKSHEET
19 October 2018

Department/School:	School of Engineering and Applied Science
College:	College of Science and Engineering

Program Name:	Technology Management
Reference Number:	575
CIP Code:	150612
Degree Type (AB, BS, etc.):	B.S
STEM+H Degree (Y/N)	Yes
Minimum Hours Required:	120
List Concentrations (if any):	NA

1. PROGRAM SUMMARY

a. Please provide a brief summary of your program to assist evaluators. Include factors such as delivery mode(s), whether an accompanying program is required (e.g., second major, minor, or certificate), supporting course requirements, and/or criteria for selective admission. (maximum 200 words)

The Technology Management (TM) program is a 2+2 online program designed specifically for students who currently hold a certificate or associates degree, from a two-year college/technical schools. The Technology Management program is a capstone program that provides a two-year management emphasis for those working toward a supervisor position in industry. Graduates are empowered to obtain positions of leadership in business, industry, or workforce development in support of innovation and global competitiveness.

Students can pursue a TM degree in three distinct ways: face-to-face classes, online classes offered in a traditional semester, and on demand. These unique delivery methods give working adults an opportunity to pursue their educational goals, while still allowing them to work and provide a living for their families and to provide the skills and expertise needed by their employer

No minor, second major, or certificate is required.

2. PROGRAM PRODUCTIVITY

a. Data Provided by IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Enrolled Students	55	67	75	65	54	89
Conferrals	13	14	25	14	22	22
SCHP	391	729	639	621	456	991

b. In what ways does the program contribute to other programs or areas of the departmental/college/university mission and priorities? For example, you might consider factors such as courses delivered in support of other major programs, involvement in a JUMP program, and interaction between undergraduate and graduate programs. Provide a brief summary and quantitative breakdown to the extent possible. (maximum 200 words)

The TM and Manufacturing Engineering Technology (MET) courses are taught by the same faculty and the programs both require many of the same classes (AMS270, AMS310, AMS342, AMS356, AMS371, AMS390, AMD 394, and AMS430). In many of the courses, students from both majors in class together.

TM and MET faculty also teach courses (AMS 140, AMS 261/262, AMS 271, AMS 305, AMS 371, and AMS 430) that support other majors in the college such as Construction Management and Architectural Science. Numerous students from computer science as well as graphics communication attend classes in CAD (computer-aided design) as electives. TM and MET faculty also teach courses in the Master of Science program in Engineering Technology Management which includes a JUMP program.

c. What else should evaluators know about this program's productivity? (optional, maximum 100 words)

Over time, the program has increased the number of seats in lecture classes to 45 but routinely allow as many as 50 student to enroll in lecture and online classes.

According to a new policy, programs must offer both face-to-face and online sections of courses for non-online students. In the past, the program could combine resources with the MET program to offer either a face-to-face or only section each semester. Beginning in the spring semester, the programs will have to offer classes in both delivery modes. This will be very challenging with the current staffing level.

3. SUCCESS OF STUDENTS

a. Data Provided by IR	2013-14		2014-15		2015-16		2016-17		2017-18		17/18 Univ. Values
	N	%	N	%	N	%	N	%	N	%	
First-Year Retention Rate	2	100.0	1	100.0	1	100.0	4	75.0	2	50.0	69.4%
Progression			26	57.7	26	61.5	34	41.2	25	44.0	61.3%
150% Graduation Rate	1	100.0	0	0	1	0.0	1	0.0	2	100.0	54.1%
Time to Degree	5.67 (N=11)		4.87 (N=13)		4.97 (N=23)		2.95 (N=14)		4.54 (N=20)		4.39

b. List program student learning outcomes and means of assessment. Minors and certificates may or may not have SLOs that differ from those of a major; if they do not, use the SLOs for the major. Describe one best example of how findings from a recent round of assessment were used to improve the program (i.e., closing-the-loop). (maximum 300 words)

Because this program is closely aligned with the MET program, the program has the same student learning outcomes (SLOs).

At the time of graduation, the students should have attained the following SLOs:

1. Graduates will possess/ demonstrate the ability to identify, formulate strategies and solve technical problems.
2. Graduates will demonstrate an ability to communicate effectively in pertinent areas, both written and graphic,
3. Graduates will demonstrate the knowledge and capacity to apply managerial/ leadership principles and practices to appropriate situations.

c. In what ways does the program try to systematically gather and incorporate feedback on the success of graduates in gaining employment and/or progressing onto graduate/professional school (e.g., pass rates on national exams, alumni feedback, graduate/professional school acceptances)? What are the key areas of professional opportunity for students graduating from the program? Reference relevant employment statistics and/or provide supplemental data to the extent possible. (maximum 200 words)

Students are very successful from the TM program. Placement stays at or near 100% for all graduates each year. Graduates work for a wide variety of businesses locally and globally in a wide variety of positions. Typical starting salaries range from $45,000-$60,000 with an average starting salary around $55,000 per year.

Graduates from this program have good technical skills that help them grow as great managers with extensive technical knowledge. This program is designed to allow students who have technical capabilities to move into supervisory and management positions including Quality Manager, Systems Integrator, Process Engineer, Engineering Manager, Facilities Manager, Maintenance Supervisor, Technology Educator, and Safety/Environmental Manager.

According to information provided by JobsEQ, motor vehicle parts manufacturing (26.8%), plastics production manufacturing (5.5%), and alumni and aluminum production and processing (2.1%) are the top industries in south central Kentucky. TM graduates are hired as managers for all of these sectors.

d. In what ways does the program try to systematically gather and incorporate feedback regarding needs and/or satisfaction of employers in order to ensure the curriculum is aligned with the necessary employability skills (e.g., employer surveys, advisory boards, national data)? Provide one best example where the information gained was used to improve the program. (maximum 200 words)

The TM program has an advisory board of industry experts some of whom are program alumni. During annual meetings, the members are asked to review the curriculum and make suggestions on improvements.

One example of using information from the advisory board to improve the program is combining two similar courses into one. This improvement allowed more efficient use of precious faculty resources and streamlined the graduation requirements for students.

e. What else should evaluators know about the success of students in this program? (optional, maximum 100 words)

4. COSTS, REVENUE AND EFFICIENCY

a. Data Provided by AA/IR	2013-14	2014-15	2015-16	2016-17	2017-18	17/18 Univ. Median
Number of TE Faculty					1.07	12
Number of NTE Faculty					0.49	4
Cost per SCH					$161	$128
SCHP/FTF by Dept.	284	359	449	408	394	375
% SCH by FTF by Dept.	80.6%	80.9%	88.3%	84.9%	85.3%	75.8%
Median Class Size by Level	17	17	18	19	19	19
% Under-Enrolled Sections by Level	36.9%	42.9%	35.5%	35.5%	34.3%	36.3%

b. What external revenue streams are directly associated with the program? For example, consider research grants that require/engage program students and/or provide faculty buy-out time, philanthropic potential, DELO revenue, corporate-university partnerships, and economic development relationships with communities that generate additional support for the program, department, college, and/or university. (maximum 200 words)

The program has access to a small foundation account that is shared by five programs. The average value over the past five years is $4,662. The program also generates DELO money due to the online nature of the program.

c. What else should evaluators know about program costs, revenue, and efficiency? For example, if the data provided for the department as a whole differ substantially from that of the program, please address. (optional, maximum 100 words)

The foundation money available to the program is not intended to support the daily needs of the program. Course fees and DELO funds help sustain the program.

5. PROGRAM ALIGNMENT AND DISTINCTIVENESS

a. What aspects of WKU's strategic plan are directly addressed by this program? Reference specific goals, objectives, strategies and metrics. (maximum 200 words)

The focus of the strategic plan is "to ensure that students can graduate in four years fully prepared to enter the workplace or pursue a graduate degree." As discussed above, the graduates of the TM program are prepared to successfully gain employment in the workplace and thus support the needs of regional industry.

Another aspect of the strategic plan supported by the program is that students "will have access to high-impact practices (HIPs) such as internships, study-abroad, service learning, and undergraduate research throughout their college career." The program has a required capstone design course and required internship.

A third aspect supported is to "engage with the communities we serve to be a resource and partner in finding innovative solutions to social, economic, and other challenges."

b. What aspects of the statewide strategic agenda are directly addressed by the program? Reference specific goals, policy objectives, strategies, and metrics. (maximum 200 words)

This program supports several aspects of the statewide strategic agenda:

- Objective 2.8. Partner with Advance KY, Project Lead the Way, and other similar programs to improve academic instruction and interest in STEM disciplines in high school.
- Objective 7.2: Increase 2-year to 4-year transfer by providing more degree pathways, completer (2+2) programs, and transfer advising.
- Objective 9.3: Work with the employer community, foundations, and state agencies to provide "work and learn" opportunities, including experiential or project-based learning, co-ops, internships, externships, and clinical experiences.
- Objective 10.4: Increase opportunities for undergraduate students to conduct or assist in research.
- Objective 10.5: Foster a more innovative, creative, and entrepreneurial culture within the postsecondary community.

c. How and to what extent does the program directly address workforce needs in Kentucky and/or demand in the profession? Reference relevant workforce and/or provide supplemental data to the extent possible. (maximum 200 words)

The TM programs sole focus is on supporting work force needs. The typical TM student is someone who has already graduated from a vocational/technical/community college and is currently employed in his or her field. The TM program gives employees on opportunity to pursue a degree and then a career in a managerial role in the companies they are already employed in. The tuition of many TM students is paid for by their employers. TM students come from a wide variety of industries ranging from automotive manufacturing to food processing plants. Historically, the manufacturing sector went through several years of negative growth. However, manufacturing both nationally and locally is now on the rise. This trend is due to more companies on/near shoring back to the US and the large number of baby boomers who are now well into their retirement window. This will undoubtedly contribute to our students and our program being in high demand.

d. In what ways is the program distinctive in design/delivery, reputation, and impact? Reference unique aspects of the program relative to similar programs, and point to indicators of reputation in Kentucky and/or the nation. Discuss contribution to student/faculty/staff diversity, DELO cohort component, regional campus impact, and other factors as appropriate. (maximum 200 words)

The TM program was the first 2+2 program in Kentucky. The program has been able to evolve with industry as the curriculum is reviewed twice a year by an advisory committee made up solely of industry representatives. Because of the unique course delivery, the program enrolls students from local industry in Bowling Green and surrounding counties as well as students from as far away as Alaska and California.

Several program alumnae are now in management roles and thus our reputation is widely known by industry and in the KCTCS system. Recently the program coordinator was contacted by a representative of Blue Grass Tech College who indicated their desire to work with the program more closely since "we have a great 2+2 program." The program faculty also work closely with regional campus sites at Glasgow and Owensboro and conduct advising meetings at the Glasgow campus approximately once per month.

e. What else do evaluators need to know about the program's strategic alignment and distinctiveness? (optional, maximum 100 words)

Articulation agreements exist between the TM program and every KCTCS college in Kentucky. Program faculty also have worked closely with IVY TECH in Indiana in an effort to form alliances which an aid in continuing to increases enrollments and opportunities for students who desire to attend WKU to do so easily and seamlessly.

6. PROSPECTUS

a. What opportunities do you see for the program going forward? For example, where are potential new markets for students, how might the program be revised to take advantage of emerging trends in the discipline, how could new interdisciplinary connections be made to increase the demand and quality of the program? (maximum 200 words)

Over the next few years, the relationship with KSCTS will be strengthened. By travelling to KCTCS locations monthly, the faculty will be able to market the program directly to potential students and raise awareness of the unique opportunities that a 2+2 program has to offer. The WKU faculty can also build a positive relationship with KCTCS transfer counselors and the faculty.

In an effort to build more interdisciplinary connections within the School of Engineering and Applied Sciences, faculty members from TM and the Computer Information Technology programs are now working on ways to more closely aligning the curricula such as cross listing courses so that students can take classes in both program areas easily. The goal is to offer courses that focus on IT management, digital data collection, and network security. This is a natural growth area for both programs because modern industrial operations and management rely heavily on technology to schedule production, program machinery and robotics, purchase and manage inventory.

b. How do program trends align with national trends over the last 5-10 years? (maximum 200 words)

The TM program has evolved through input from business and industry since its inception. Courses in the program have been changed to reflect what is relevant in industry. The program is continuing to evolve to meet the changing technological landscape. TM students are required to complete at least 3 credit hours of project coursework. These projects are completed at the students' current workplace. This window into industrial practices allows the faculty to remain current with the latest trends as they work with students and their employer in developing project proposals and time lines and evaluating the results and impact of the project with the student's direct supervisors.

c. What if any significant changes has your program instituted within the past three years to increase productivity, success of students, and/or efficiency that may not yet be evident in the data provided? Examples might include revised course sequencing/scheduling designed to enhance students' progress towards degree, implementation of a comprehensive recruiting and marketing plan, or reallocation of faculty resources to better align with demand. (maximum 200 words)

Program faculty have worked with DELO to improve the online course offerings. Over the last year, program faculty have recommitted to marketing the program which targets specific demographic groups that could benefit from such a program. The marketing plan includes monthly visits to KCTCS schools and soliciting local employers to recruit onsite.

At the beginning of the Fall 2018, the program name was changed to "Engineering Technology Management" which will be effective in the 2019-2020 catalog. The name change was a marketing strategy in response to the needs of community college students that need a program that will allow them to complete a degree in an area related to engineering with a degree title that reflects such.

d. Where do you see the program in five years? In ten years? What would it reasonably take to get there? What impediments currently exist? (maximum 200 words)

The TM program will expand its reach to include more computer information technology topics for students who want to pursue a management career in those fields. The demand from industry will increase as more of the experienced work force retires. The TM graduates will be in a unique position to fill the void with their hands-on experience from KCTCS coupled with their WKU management knowledge.

Impediments to the program include the new online course fee of $150/credit hour for students who pursue classes both online and face to face. Program faculty feel giving students options of taking class face to face, on demand, and online is beneficial. However, that benefit is lost if students cannot afford the fees. Another issue faced is the implementation of the WKU workforce development degree. The TM faculty were not consulted regarding this program and are now being forced to compete against another WKU group for the same students. This degree is very closely related to the existing TM degree

including requiring many of our courses. It could be beneficial to merge the workforce development degree into the TM degree since because the TM degree has proven success with this type of training.
e. What recommendation would you put forward for the program (check one)?

☒ Grow/Enhance (Significant strategic potential exists)	☐ Maintain (Core or important complementary program)
☐ Transform (Redesign/combine/reorient)	☐ Suspend (Teach-out may be required)