COMPREHENSIVE ACADEMIC PROGRAM REVIEW

Note: Enter "NA" wherever data are not applicable or not available for the program under review.

Program Characteristics
Academic Program Name: **Chemistry**
Degree: **Bachelor of Science (B.S.)**
Program CIP Code: **40.0501**
School and Department: **School of Arts and Science – Department of Physical Sciences**
Time frame for this review: **2014/2015 – 2018/2019**
Date of last internal review: **2014**
Current date program reviewed for this report: **Spring 2020**

Program Goal Statement and Student Learning Outcomes
Program goal statement: Graduates of the B.S. Chemistry program will complete comprehensive course work designed to give them in-depth knowledge of chemistry, laboratory skills, and research skills which will enable them to apply scientific processes to address questions of chemical relevance and clearly communicate their findings in written and oral forms.
Program outcomes: 1. Knowledge and laboratory skills in relevant chemistry. Graduates of the B.S. in Chemistry program will demonstrate comprehensive understanding of the key student learning outcomes and critical skills in one of the following four concentrations of chemistry: general chemistry, environmental chemistry, industrial chemistry, or pre-health chemistry. 2. Graduate satisfaction with the chemistry program. Candidates for graduation in the B.S. in Chemistry program will report a high level of satisfaction with the program. 3. Graduates will be successful. Graduates of the B.S. in Chemistry program will find employment related to their degree or gain acceptance in graduate or professional schools.
Student learning outcomes: 1. Students will develop critical thinking skills by predicting reactions and determining how to best synthesize certain organic compounds. 2. Students will explain the practical use of the most widely used instrumental techniques for chemical analysis and select appropriate instrumentation and methods for problems in chemical measurement. 3. Students will apply the Schrodinger equation to realistic systems to predict outcomes of measurable quantities.

4. Students will predict electronic structure and properties in metallic systems with reference to molecular orbital theory, crystal field theory, and ligand field theory and apply and understand the limitations of each of these bonding models.
5. Students will gain knowledge and understanding in laboratory methodology including data observation, recording, analysis, and reporting.

Brief Assessment of Previous Program Review

Outcome of previous program review (brief narrative statement).

The chemistry program is not only an important and viable program in the School of Arts and Sciences, but it is also an important program to the community. The program produces graduates who are well prepared for graduate or professional school or for professional employment in high demand areas of industry and academia. The continuing job outlook for graduates of the program is very good. From the previous review's action plan, a STEM Advisory Council has been established which is comprised of STEM faculty members in the School of Arts and Sciences, faculty members from the Wright School of Business, and several local industry leaders. This council provides an avenue for open lines of communication between Dalton State and local industry providing opportunities for us to better understand and meet industry needs, open opportunities for internships, and allow our students to see real-world applications of what they have learned in the classroom.

What improvements have occurred since the last program review or assessment?

- Changes have been made to address the assessment of the program and also to make the program even more relevant for our students in the current graduate/professional school and employment climate.
- The opening of Peeples Hall provided additional classroom and lab space and new equipment, allowing undergraduate research in the chemistry program to more fully develop and flourish.
    - Peeples Hall opened in January 2014 providing much needed space and equipment for the growing chemistry program.
        - 60,000 ft^2
        - 3 chemistry labs for teaching
        - 1 chemistry research lab
        - 2 chemistry labs that are used for both teaching and research
    - With the opening of Peeples Hall came the addition of state-of-the-art equipment.
        - HPLC – High performance liquid chromatograph
        - AA – Atomic absorption spectroscope
        - ICP – Inductively coupled plasma spectroscope
        - DSC – Differential scanning calorimeter
        - GCMS – Gas chromatography mass spectrometer
        - LCMS – Liquid chromatography mass spectrometer
        - NMR – Nuclear magnetic resonance spectroscope
        - FTIR – Fourier-transform infrared spectroscope
        - SEM – scanning electron microscope
        - Fluorescent microscope
- New safety manuals were written.
    - DSC Chemical Hygiene Plan
    - Laboratory Safety Manual
- Many students are involved in undergraduate research. During this review period, at least 57 chemistry majors were involved in undergraduate research. This number represents students

receiving course credit for their research but does not include other students involved in research projects not for credit.
- New opportunities for internships in chemistry were established.
- The School of Science, Technology, and Mathematics (now part of the School of Arts and Sciences) Undergraduate Research Committee sponsors STEM Career Panels and STEM Grad School Panels each year to help prepare and inform our students.
- The addition of new chemistry courses made it possible to offer more elective courses which are more specific to students' professional goals allowing more flexibility in the program.
- The Pre-health Professions Club was established.
- No cost/low cost textbooks were used in CHEM 1151, CHEM 1212, CHEM 2000, CHEM 3700, CHEM 4000, and CHEM 4430.
- Program outcomes have been adjusted and procedures put in place to gather relevant data.

What changes or revisions have been made to the program, its curriculum, or its program/student learning outcomes since the last program review? Please include a follow-up discussion of the previous review's action plan?

- In order to allow students to choose electives related to their career goals and interests, four pathways (in addition to the existing Secondary Certification option) were created in the B.S. Chemistry program:
    - B.S. Chemistry with General Chemistry pathway
    - B.S. Chemistry with Environmental Chemistry pathway
    - B.S. Chemistry with Pre-Health Sciences pathway
    - B.S. Chemistry with Industrial Chemistry pathway
- To add flexibility to the program, the hours in the required upper-level chemistry courses and the hours of free electives were adjusted.
- Several new courses were created to provide additional diversity and flexibility to the program:
    - CHEM 3900 Readings in Chemistry
    - CHEM 4960 Research in Chemistry
    - CHEM 4420 Advanced Organic Spectroscopy
    - CHEM 4860 Internship in Chemistry
- Prerequisites for program courses were evaluated and adjusted as necessary.
- From the previous review's action plan, a STEM Advisory Council has been established which is comprised of STEM faculty members from the School of Arts and Sciences, faculty from the Wright School of Business, and several local industry leaders. This council meets twice per year giving an avenue for open lines of communication between Dalton State and local industry, providing opportunities for us to better understand and meet industry needs and open opportunities for internships.

Student Demographics

Enrollment	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	% Change
Chemistry						
Headcount	93	96	113	103	81	-12.9
FTE	84.5	86.0	104.7	93.3	72.4	-14.3
Enrolled Full-time	67	67	92	72	56	-16.4
Enrolled Part-time	26	29	21	31	25	-3.8
Chemistry with Secondary Certification						
Headcount	4	7	5	7	6	50.0
FTE	3.6	6.2	3.6	6.5	5.9	63.9
Enrolled Full-time	3	5	3	5	5	66.7
Enrolled Part-time	1	2	2	2	1	0
Combined Chemistry and Chemistry Education						
Female	47	45	54	50	42	-10.6
Male	50	58	64	60	45	-10.0
Alaskan Native/Native American/American Indian	0	1	0	0	0	[1]DNE
Asian, Hawaiian, Other Pacific Islander	6	8	8	7	5	-16.7
Black/African-American	6	4	5	2	1	-83.3
Hispanic	12	16	21	24	29	141.7
Multi-racial	3	1	4	4	3	0
Undeclared	3	5	2	0	0	-100.0
White	67	68	78	73	49	-26.9

Analysis and comments on student demographics.

Enrollment in the chemistry program decreased by 12.9% (14.3% for FTE), while enrollment in chemistry education increased 50% (63.9% for FTE) during the review period. Full-time and part-time enrollments followed the same trend with a decline in the chemistry program and an increase of 66.7% in full-time enrollment in chemistry education. Some of the overall decline in enrollment may be attributed to graduating students in the program. As noted on page 15, the number of graduates increased 260% during the review period. In terms of ethnicity, enrollment of white students declined during the review period by 26.9%, but enrollment of Hispanic students increased 141.7%. The ratio of male to female remained virtually unchanged over the review period going from 50:47 to 45:42.

[1]DNE is a mathematical abbreviation for "Does Not Exist" often used for undefined expressions or when a proper solution does not exist.

Faculty Indicators of Program Quality	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**% Change**
Full-time program faculty	6	5	6	6	7	16.7
Part-time program faculty	2	2	3	3	2	0
Total program faculty	8	7	9	9	9	12.5
Percent of program classes taught by full-time program faculty	94	95	96	89	94	0
Gender (full-time and part-time faculty)	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**% Change**
Male	4	5	6	7	6	50
Female	4	2	3	2	3	25
Race/Ethnicity (full-time and part-time faculty)	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**% Change**
Alaskan Native/Native American/American Indian	0	0	0	0	0	DNE
Asian, Hawaiian, Other Pacific Islander	0	0	1	1	2	DNE
Black/African-American	0	0	0	0	0	DNE
Hispanic	1	1	0	0	0	-100
Multi-racial	0	0	0	0	0	DNE
Undeclared	0	0	1	1	1	DNE
White	7	6	7	7	6	-14.3
Tenure Status (full-time faculty)	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**% Change**
Tenured	3	3	3	3	3	0
On-tenure track	3	2	2	2	4	33.3
Non-tenure track	0	0	1	1	0	DNE
Rank (full-time faculty)	**Fall 2014**	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**% Change**
Professor	0	0	1	1	1	DNE
Associate Professor	4	4	3	3	3	-25
Assistant Professor	2	1	1	1	3	50
Instructor/Senior Lecturer/Lecturer	0	0	1	1	0	DNE

Faculty Indicators of Program Quality

Highest degree (full-time faculty)	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	% Change
Doctorate	6	5	6	6	7	16.7
Specialist	0	0	0	0	0	DNE
Master's	0	0	0	0	0	DNE
Bachelor's	0	0	0	0	0	DNE
Associate's/Other	0	0	0	0	0	DNE

Provide additional details, analysis, and comments regarding faculty indicators of program quality.

The number of faculty teaching in the chemistry program has remained basically constant during the current review period with well over 90% of chemistry program classes being taught by full-time faculty. The stability and quality of the faculty are strengths of the program. All full-time program faculty are tenured or in tenure-track positions, and all hold a doctoral degree.

Indicators of Measures of Quality

Student Input	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	% Change
Mean ACT score	21.04	20.40	21.02	22.23	22.00	4.6
Mean SAT score	508	502	505	500	513	1.0

If applicable to your degree program, provide any additional external quality assurance data/information or results (e.g., professional accreditation results, National Survey of Student Engagement [NSSE], market rankings, etc.).

Neither external accrediting bodies nor market rankings are used or tracked for the chemistry program. During the review period, both the mean ACT score and the mean SAT score experienced a slight increase. Students accepted into Dalton State can self-select into the chemistry program as there are no incoming qualification criteria for the program. Internally, both professional and faculty advisors monitor student progress through the program.

Indicators of Measures of Quality

Student Output	2014-15	2015-16	2016-17	2017-18	2018-19	% Change
Exit scores on national/state licensure (If applicable)	NA	NA	NA	NA	NA	DNE
Graduating majors' mean GPA	2.96	3.48	3.41	3.30	3.42	15.5
Employment rate of graduates (if available)	NA	NA	NA	NA	NA	DNE
Number of students entering graduate/professional programs	NA	NA	NA	NA	NA	DNE

Describe the extent to which students have achieved current program outcomes during this program review cycle (most recent year).

Program outcomes:

1. Knowledge and laboratory skills in chemistry

Courses in the chemistry program are regularly assessed by the chemistry faculty using WEAVE as the reporting platform. During 2018-19, several courses in the program were assessed. Four of these courses are referenced here as they are central and required courses in the program – CHEM 3212 Organic Chemistry II, CHEM 3312 Instrumental Analysis, CHEM 3412 Physical Chemistry II, and CHEM 4110 Advanced Inorganic Chemistry. Course-level GPAs for these courses averaged 3.0, and assessment results from the courses demonstrated that students had understanding of the key student learning outcomes and critical skills of the program.

2. Graduate satisfaction with chemistry program
3. Graduates will be successful

Data regarding these two program outcomes has not been regularly collected. Beginning with the 2019-20 academic year, a new assessment plan has been put in place to aid in regularly collecting these data.

Describe the extent to which students have achieved current student learning outcomes during this program review cycle (most recent year).

1. Students will develop critical thinking skills by predicting reactions and determining how to best synthesize certain organic compounds.

CHEM 3212 Organic Chemistry II

Target - Incorrect answers will be reduced by 50% from the pretest to the posttest.

Findings - Questions 1 and 2 on the pretest/posttest assessed students' ability to interpret spectra and identify simple organic compounds using spectra. On the pretest, there were 47 incorrect answers on questions 1 and 2. On the posttest, there were 24 incorrect answers on questions 1 and 2. The percent decrease in incorrect answers on Questions 1 and 2 from pretest to posttest is (47 - 24) / 47 = 48.94%.

Action Plan for Improvement - Because the target of 50% reduction in incorrect answers from pretest to posttest was not met on Q1, more class time will be devoted to IR analysis to help students recognize functional groups in IR spectra.

*An example of an Action Plan for improvement when a target is not met was given, but other Action Plans for Improvement will not be given here as they are detailed within the course assessments in Weave. See the note at the end of this section

Target - Incorrect answers will be reduced by 50% from the pretest to the posttest.

Findings - Questions 4, 6, and 8 on the pre-test/post-test assessed students' ability to understand chemical reactivity and molecular structure of aromatics, alcohols, amines, and carbonyl compounds. On the pretest, there were 70 incorrect answers on questions 4, 6, and 8. On the posttest, there were 29 incorrect answers on questions 4, 6, and 8. The percent decrease in incorrect answers on Questions 4, 6, and 8 from pretest to posttest is (70 - 29) / 70 = 58.57%.

Target - Incorrect answers will be reduced by 50% from the pretest to the posttest.

Findings - Questions 3, 7, and 10 on the pre-test/post-test assessed students' ability to understand reaction mechanisms with respect to electronic movement. On the pretest, there were 61 incorrect answers on questions 3, 7, and 10. On the posttest, there were 21 incorrect answers on questions 3, 7, and 10. The percent decrease in incorrect answers on Questions 3, 7, and 10 from pretest to posttest is (61 - 21) / 61 = 65.57%.

Target - Incorrect answers will be reduced by 50% from the pretest to the posttest.

Findings - Questions 5 and 9 on the pre-test/post-test assessed students' ability to predict reactions and determine how to best synthesize certain organic compounds. On the pretest, there were 38 incorrect answers on questions 5 and 9. On the posttest, there were 15 incorrect answers on questions 5 and 9. The percent decrease in incorrect answers on Questions 5 and 9 from pretest to posttest is (38 - 15) / 38 = 60.53%.

2. Students will explain the practical use of the most widely used instrumental techniques for chemical analysis and select appropriate instrumentation and methods for problems in chemical measurement.

CHEM 3312 Instrumental Analysis

Target - Students will correctly answer at least 70% of questions on the posttest or improve their score by at least 40% from pretest to posttest.

Findings – Questions 1-7 assessed students' ability to explain the theory of and interpret data from the most widely used instrumental techniques for chemical analysis. Question 1 tests student knowledge of the factors that affect atomic emission line width. Question 2 tests student knowledge of the design and function of common types of mass spectrometer. Question 3 tests student knowledge of the effect of monochromator design on performance. Question 4 tests student knowledge of the detailed process by which a molecule undergoes fluorescence. Question 5 requires students to interpret a differential scanning calorimetry thermogram. Question 6 tests student knowledge of the effect of column temperature in gas chromatography. Question 7 tests student knowledge of the effect of stationary phase particle size on liquid chromatography. 56% correctly answered at least 70% of the questions correctly or improved their score by at least 40% from pretest to posttest.

Target – Students will correctly answer at least 70% of questions on the posttest or improve their score by at least 33% from pretest to posttest.

Findings - Questions 8-14 assessed students' ability to explain the practical use of the most widely used instrumental techniques for chemical analysis and select appropriate instrumentation and methods for problems in chemical measurement. Question 8 requires students to select the best instrumental technique for trace elemental analysis. Question 9 requires students to select the mass spectrometery ionization technique that results in the greatest amount of fragmentation. Question 10 requires students to select the mass spectrometery ionization technique that is used for elemental analysis. Question 11 requires students to select the instrumental technique that is used for surface analysis. Question 12 requires students to apply the concept of mobile phase strength in liquid chromatography and predict its effect on a chromatogram. Question 13 requires students to select the instrumental technique that would be the best choice to perform trace analysis of a polycyclic aromatic hydrocarbon in a mixture of similar compounds. Question 14 requires students to select the best instrumental technique for a problem for which near IR spectrometry with multivariate calibration would be ideal. 33% of students achieved the goal.

3. Students will apply the Schrodinger equation to realistic systems to predict outcomes of measurable quantities.

CHEM 3412 Physical Chemistry II

Target - Fifty percent of the class will achieve a rating of 'excellent' on a question related to the superposition of eigenstates.

Findings - Of the 13 students completing the rubric-based question on molecular orbitals, five students, or 38%, received a rating of 'excellent,' while 53% received a rating of 'satisfactory' (seven students), and one student (8%) submitted unsatisfactory work.

4. Students will predict electronic structure and properties in metallic systems with reference to molecular orbital theory, crystal field theory, and ligand field theory and apply and understand the limitations of each of these bonding models.

CHEM 4110 Advanced Inorganic Chemistry

Bonding and Molecular Properties - the bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances, and bond energies using MO diagrams and thermodynamic data.

Target – 60% of students will earn at least 70% of the possible credit on questions that test this SLO.

Findings – 73% of students earned at least 70% of the possible credit on these questions.

Symmetry and Point Group Theory - the use of group theory to recognize and assign symmetry characteristics to molecules and objects, and to predict the geometry of the molecules.

Target – 60% of students will earn at least 70% of the possible credit on questions that test this SLO.

Findings – 20% of students earned at least 70% of the possible credit on these questions.

Chemistry of Main Group Elements - the fundamentals of the chemistry of the main group elements, and important real-world applications of many of these species.

Target – 60% of students will earn at least 70% of the possible credit on questions that test this SLO.

Findings – 100% of students earned at least 70% of the possible credit on these questions.

5. Students will gain knowledge and understanding in laboratory methodology including data observation, recording, analysis, and reporting.

CHEM 3212 Organic Chemistry II

The final formal laboratory report in CHEM 3212 will be used to assess students' knowledge and understanding in laboratory methodology including data observation, recording, analysis, and reporting.

Target - 75% of students will achieve an 85% or higher on the final formal laboratory report.

Findings - 94% of students achieved an 85% or higher on the final formal laboratory report.

CHEM 3312 Instrumental Analysis

Students will demonstrate their ability to use instruments to perform chemical measurements and to manipulate and interpret laboratory data by writing reports. The reports will emulate a paper in a technical journal with these sections: Abstract, Introduction, Experimental, and Discussion of Results. In the introduction, students will show their understanding of the instrumental and laboratory techniques being employed. In the Experimental section, students will select the critical information needed by a chemical professional to duplicate the experiment and will present it as briefly as possible, as is the convention in technical papers. In the Results and Discussion section, students will present their results and show their understanding of them.

Target – 70% of students will earn at least 70% on at least 70% of their lab reports.

Findings - 73% of students met the target.

CHEM 3412 Physical Chemistry II

Target - 50% of students will properly graph data collected for the Photoelectric Effect lab and draw appropriate conclusions from it.

Findings - Of the 11 students submitting a lab report for this experiment, two students (18%) presented the data correctly while nine students (81%) did not.

CHEM 4110 Advanced Inorganic Chemistry

Students will demonstrate their ability to synthesize and characterize inorganic chemicals by writing reports in which they present and interpret their experimental results. The reports will emulate a paper in a technical journal with these sections: Abstract, Introduction, Experimental, and Discussion of Results. In the introduction, students will show their understanding of the chemical concepts and techniques that are applied in the experiment. In the Experimental section, students will select the critical information needed by a chemical professional to duplicate the experiment and will present it as briefly as possible, as is the convention in technical papers. In the Results and Discussion section, students will present their results and show their understanding of them.

Target – 70% of students will earn passing grades on their lab reports.

Findings – 93% of students earned passing grades on their lab reports.

*The findings in this section describe the extent to which the student learning outcome targets were achieved during the most recent year (2018-19) of the review period. When a target is not met, an Action Plan for Improvement is put in place by the instructor at the course level. These plans for improvement can be found in each course assessment in WEAVE.

Indicators of Measures of Quality

If available, provide additional information and/or results of other indicators of quality related to student output such as completer satisfaction surveys, employer satisfaction surveys, stakeholder satisfaction surveys, completion and continuation rates, attrition rates, starting salaries of graduates, etc.

As noted earlier, obtaining employment placement and graduate/professional school acceptance rates has been problematic. Data regarding these measures has not been regularly collected. We do know that graduates we are in contact with have found professional employment or graduate/professional school opportunities upon graduation. Beginning with the 2019-20 academic year, a new assessment plan has been put in place to aid in regularly collecting this data. In addition to assessing the student learning outcomes, surveys of candidates for graduation in the program will measure their overall satisfaction with the program, and surveys of graduates will measure their success in finding employment or gaining acceptance into graduate or professional schools.

Describe efforts undertaken to achieve and maintain curricular alignment within the program and currency to the discipline.

The School of Science, Technology, and Mathematics (now part of the School of Arts and Sciences) has a standing curriculum committee. At least one member of the science faculty serves on the committee along with other faculty members from the school. Faculty members and advisors can make proposals to the curriculum committee regarding changes to the chemistry program curriculum. These proposals are reviewed and discussed based on their accompanying rationale. Rationales for curricula changes often reference comparisons to other institutions in the USG to ensure that our curriculum remains relevant and consist with that of other comparable schools.

During the 2014-15 academic year, CHEM 3900 Readings in Chemistry and CHEM 4960 Research in Chemistry were created to give students the opportunity to explore a subject in greater depth under the guidance of a faculty member. These courses actively involve students in research through course-based student-led literature reviews and faculty-driven laboratory research, enabling them to develop scientific-based research skills and techniques through projects inspired from previous coursework as well as working with faculty on existing research projects.

In 2015-16, CHEM 4420 Advanced Organic Spectroscopy was created, providing hands-on training with spectrometers and practical experience in deriving the structures of organic molecules.

During 2017-18, CHEM 4860 Internship in Chemistry was created to provide students with an opportunity for an in-depth, work-related, learning experience conducted at Dalton State and/or in a position in local industry.

In 2018-19, four pathways (in addition to the Secondary Certification option) were created in the B.S. Chemistry program to allow students to choose electives related to their career goals and interests: General Chemistry pathway, Environmental Chemistry pathway, Pre-Health Sciences pathway, and Industrial Chemistry pathway.

Indicators of Measures of Viability

Internal Demand for the Program	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	% Change
Number of students enrolled in the degree program	97	103	118	110	87	-10.3
Number of students who applied to the program (if applicable)	NA	NA	NA	NA	NA	NA
Number of students admitted to the program (if applicable)	NA	NA	NA	NA	NA	NA
Percent of classes taught by full-time faculty	94	95	96	89	94	0

Describe additional details as deemed appropriate.

Enrollment in the chemistry program declined by 10.3% (11.1% for FTE) during the current review period. Some of the decline in enrollment may be attributed to graduating students in the program. As noted on page 15, the number of graduates increased 260% during the review period. However, to address the decline in program enrollment, the School of Science, Technology, and Mathematics (now part of the School of Arts and Sciences) Undergraduate Research Committee holds STEM Career Panels with graduates in STEM fields, including chemistry, to inform and entice students to the program. The program has also been enriched for current students in the program with new opportunities for internships in chemistry having been established. Additional student demographics are addressed more fully on page 5. As indicated in the faculty demographics on pages 6-7, the number of faculty teaching in the chemistry program has remained basically constant during the current review period with over 90% of chemistry program classes being taught by full-time faculty.

Indicators of Measures of Productivity

Graduation	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**% Change**
Number of degrees conferred – Chemistry	5	9	11	14	18	260
Number of degrees conferred – Chemistry with Secondary Cert	0	1	0	0	0	DNE
Total student credit hours earned – Chemistry/Chemistry Ed	130	129.8	127.8	104	119.14	-8.4

Describe any institutional-specific factors impacting time to degree.

In order to make the most efficient and effective use of faculty resources, required courses are offered so that students can progress through the program and graduate on time. The number of students in the program, along with the fact that the number of graduates almost tripled during the review period, requires that careful attention be given to the number of sections offered so as not to impede the progress of students towards graduation while at the same time not offering too many sections resulting in low course densities. The schedule is monitored closely by the department chair and advisors to make any necessary adjustments. The number of elective courses offered along with free electives, service-learning courses, and research courses in the program also allows for flexibility in choosing courses. Although degrees conferred in Chemistry with Secondary Certification have been historically low, it is still a viable part of the program as it requires no additional departmental resources to provide this pathway.

Evidence of Program Viability

Based on evidence from **ALL** of the above information, data, and analysis, discuss whether continued resources should be devoted to this program. This discussion must be evidence-based. Your comments should consider external factors and address questions such as the following: Are your students getting jobs? What is the job outlook for graduates? Are students prepared for the jobs they get? How is the field changing? Are program faculty members in contact with employers and getting back feedback on graduates' job performance? Do employers state or suggest a need for changes in the program?

Graduates of the chemistry program can be employed in a number of fields. With its four pathways, along with the secondary certification option, the program provides enough flexibility in preparation for positions in the private sector and in government agencies or academia for industrial chemists, environmental chemists, or general chemists along with preparation for continued graduate education. Students focusing on pre-health science graduate with a strong foundation required for post-graduate professional programs and degrees including medicine and pharmacy.

The U. S. Bureau of Labor Statistics *Occupational Outlook Handbook* reports that as of September 2019, overall employment of chemists is projected to grow 4% from 2018 to 2028. During this period, jobs in specific fields such as pharmaceutical and medicine manufacturing are expected to increase 10.7%, with jobs in educational services expected to increase 7.2%. It also reports that chemists who have laboratory experience outside of a classroom environment, such as through an internship, are likely to meet with better employment prospects after graduation.

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Chemists and Materials Scientists, https://www.bls.gov/ooh/life-physical-and-social-science/chemists-and-materials-scientists.htm (Accessed 22 April 2020).

Although the number of students enrolled in the chemistry program is down from its high in 2016, the number of graduates more than tripled during the review period. Graduates that we are in contact with have found professional employment or graduate/professional school opportunities upon graduation. Many students who participated in an internship have been offered full-time employment by the employer upon graduation. With the favorable job outlook for graduates of the chemistry program along with the number of students in the major, the chemistry program continues to be a viable program. Although degrees conferred in Chemistry with Secondary Certification have been historically low, it is still a viable part of the program as it requires no additional departmental resources to provide this pathway. Beginning with the 2019-20 academic year, a new assessment plan has been put in place to aid in regularly collecting data regarding the success of graduates.

Additionally, the STEM Advisory Council provides an avenue for open lines of communication between Dalton State and local industry providing opportunities for us to better understand and meet industry needs. The council meets twice per year.

Program Strengths and Weaknesses

Based upon this review, what are the strengths and weaknesses of the program?

Strengths:

- The chemistry program content is very thorough and rigorous, making it excellent preparation for students as they pursue graduate/professional school or employment.
- Program course offerings are varied and flexible with the following pathways to suit students' interests:
    - B.S. Chemistry with Secondary Certification
    - B.S. Chemistry with General Chemistry pathway
    - B.S. Chemistry with Environmental Chemistry pathway
    - B.S. Chemistry with Pre-Health Sciences pathway
    - B.S. Chemistry with Industrial Chemistry pathway
- Opportunities for undergraduate research are available and encouraged by the faculty.
- Many local opportunities for internships are available.
- Many students participate in service learning.
- The program has dedicated, well-qualified, and student-centered faculty.
- An average of 94% of all program courses are taught by experienced full-time faculty.
- Chemistry education students have a 100% pass rate on the GACE chemistry content exams.
- Graduates that we are in contact with have found professional employment or graduate school opportunities upon graduation.
- There is a very favorable job outlook for graduates of the program.
- The School of Science, Technology, and Mathematics (now part of the School of Arts and Sciences) has open lines of communication with local industry and school systems concerning the program to address ongoing industry and community needs.

Weaknesses and concerns:

- Very little data have been collected from graduates concerning their overall satisfaction with the program and their success in finding employment or acceptance into graduate school after graduation.
- Measuring program outcomes and student learning outcomes at the program level has been inconsistent.

Recommendations for Follow-Up and/or Action Plans (if needed)

Issue/Concern:

1. Enrollment in the chemistry program has declined over the last couple of years.
2. Maintaining the chemistry labs and instrumentation and procuring additional instrumentation are budgetary concerns.
3. Regarding assessment of the chemistry program, very little data has been collected from graduates concerning their overall satisfaction with the program and their success after graduation, and accurately measuring program outcomes and student learning outcomes at both the program and course level has been somewhat inconsistent.

Specific action(s):

1. Increased recruitment of students specifically for the chemistry program will be a priority along with seeking funding to provide financial assistance to all STEM majors, which will include chemistry.
2. The School of Arts and Sciences budget, lab fees, and external funding will be used to address these maintenance requirements and procurement opportunities.
3. A new assessment plan has been put in place for 2019-20 going forward to aid in regularly collecting data for the overall assessment of the chemistry program through graduate surveys and better evaluation of program and course level outcomes.

Expected outcomes:

1. Aggressive recruitment and financial assistance will aid in increasing enrollment in the chemistry program.
2. Budget allocations, lab fees, and external funding will allow for proper maintenance of labs and instrumentation and procurement of additional instrumentation.
3. New attention to the program and course level assessments along with surveys of graduates will aid in consistency and quality of data that is useful to the overall assessment of the program.

Time frame for achievement:

1. Recruitment and seeking financial assistance for students is currently underway and will be ongoing.
2. Available budget monies, lab fees, and external funding are currently being used with additional external funding being sought, and this will be ongoing.
3. A new assessment plan has been put in place beginning 2019-20, but this will be an ongoing process.

Person(s) responsible:

1. Primary responsibility lies with the dean, assistant deans, department chair, program/STEM faculty, and STEM advisors.
2. Primary responsibility lies with the dean, assistant deans, and department chair.
3. Primary responsibility lies with the chemistry program director and the department chair.

Resources needed:

1. None at this time
2. None at this time
3. None at this time.

DALTON STATE

COMPREHENSIVE ACADEMIC PROGRAM REVIEW

Prepared by:

Signature Lee Ann Simmons **Date:** 07/09/2020

Dean's Approval:

Signature: _____ **Date:** 7/9/2020

Approval of the Chair of the DSC Comprehensive Program Review Committee:

Signature: _____ **Date:** 7/10/2020

Vice President of Academic Affairs (VPAA) Categorical Summation:

Check any of the following to categorically describe action(s) the institution will take concerning this program.

☐ Program **MEETS** Institution's Criteria

- ☐ Program is critical to the institutional mission and will be retained.
- ☐ Program is critical to the institutional mission and is growing, or a high demand field, and thus will be enhanced.

☐ Program **DOES NOT MEET** Institution's Criteria for continuation.

- ☐ Program will be placed on monitoring status.
- ☐ Program will undergo substantive curricular revisions.
- ☐ Program will be deactivated.
- ☐ Program will be voluntarily terminated.
- ☐ Other (Please elaborate):

VPAA Signature: _____ **Date:** _____

Bruno G. Hicks, Ed.D.

Provost and Vice President for Academic Affairs

Dalton State College

COMPREHENSIVE ACADEMIC PROGRAM REVIEW

Prepared by:

Signature  **Date:** 07/09/2020

Dean's Approval:

Signature: _____ **Date:** _____

Approval of the Chair of the DSC Comprehensive Program Review Committee:

Signature: _____ **Date:** _____

Vice President of Academic Affairs (VPAA) Categorical Summation:

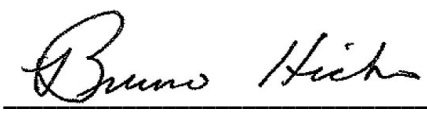
Check any of the following to categorically describe action(s) the institution will take concerning this program.

☒ Program **MEETS** Institution's Criteria

- ☐ Program is critical to the institutional mission and will be retained.
- ☐ Program is critical to the institutional mission and is growing, or a high demand field, and thus will be enhanced.

☐ Program **DOES NOT MEET** Institution's Criteria for continuation.

- ☐ Program will be placed on monitoring status.
- ☐ Program will undergo substantive curricular revisions.
- ☐ Program will be deactivated.
- ☐ Program will be voluntarily terminated.
- ☐ Other (Please elaborate):

VPAA Signature:  **Date:** 7/10/20

Bruno G. Hicks, Ed.D.

Provost and Vice President for Academic Affairs

Dalton State College