

MATH, ENGINEERING, and PHYSICAL SCIENCE

2016-2019

PROGRAM ASSESSMENT REPORT

Kevin S. Townes, Committee Chair

**Mathematics Engineering and Physical Science 2016-2019 Program Review**

**Part 1: - Program Overview**

**Program Name: Mathematics Engineering and Physical Science**

**Program Mission and Description:** The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college, and that will transfer to a baccalaureate degree-granting institution. The department also offers developmental mathematics courses to prepare students for college-level mathematics.

**Program Admission and Awards:**

The Mathematics Engineering and Physical Science Department supports the Associate in Arts, Associate in Science and the Associate in Applied Science curriculums through Area III. MTH 100 Intermediate Algebra satisfies the AAS degree general education area III mathematics requirement and is the course most often completed for this purpose. MTH 100 is also the prerequisite course for students who do not have satisfactory placement scores to enroll in MTH 112 Precalculus Algebra or MTH 110 Finite Mathematics. MTH 100 is regularly offered at all locations, in both traditional and internet formats.

Astronomy, Physics, and Physical Science, and Chemistry courses satisfy core science course requirements in Area III or Area V depending on student's declared major. In fall of 2018, a co-requisite for MTH 100 was created and designated as MTH 099.

Table 1. **Program Demographics**

|  |  |  |
| --- | --- | --- |
| **Category** | **Student Totals (3yrs)** | **Percentage (of total**  **students)** |
| **Total Students** | 18915 | 100% |
| **Number of Male** | 7965 | 42% |
| **Number of Female** | 10938 | 58% |
| **Age 18-25** | 13576 | 72% |
| **Age 26-40** | 4209 | 22% |
| **Age 41+** | 1021 | 5% |
| **African American**  **Students** | 4391 | 23% |
| **Asian Students** | 550 | 2% |
| **Caucasian Students** | 12059 | 64% |
| **Hispanic Students** | 1201 | 6% |

A review of the three-year demographic data reveals no significant change in demographics for any specific group. The gender data closely align with the percentage of males and females enrolled in the college across the three-year ranges. However, a review of course enrollment patterns indicates more males enroll in the physics courses than females when compared to other courses offered by the department. In addition, more female students enrolled in physical science classes than males during the same three-year period. This trend may reflect the national underrepresentation of

females in physics and engineering programs. Overall white students between the age of18-25 make up the largest number of enrollees in departmental courses.

**Mode of Delivery:**

The Mathematics, Engineering, and Physical Science department offer courses through a myriad of formats. These formats include traditional classroom instruction, the internet, hybrid (lecture/internet, laboratory/classroom), and video conferencing (Table. The offering of internet courses has increased slightly over the three-year period. A review of web class offering from 2016-2017 to 2017-2018 shows an increase of 12-18 internet course offerings. It is projected that internet offering will continue to grow as more students attempt to balance school, work, and personal commitments. The hybrid course offerings are only offered in Chemistry at this time.

The department will continue to add courses based on student enrollment patterns.

**Table 2:**

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|  | **2016-17**  **(Total Sections -344)** | **2017-18**  **(Total Sections-340)** | **2018-19**  **(Total Sections-325)** |
| **Traditional** | 149/43% | 151/44% | 151/47% |
| **Internet** | 79/23% | 81/24% | 72/22% |
| **Hybrid** | 102/30% | 94/28% | 89/27% |
| **Video Conference** | 14/4% | 14/4% | 13/4% |

**Program/Department Goals:** Please list your program/department goals below:

* Provide freshman and sophomore-level coursework which meets or exceeds the standards of public institutions of higher learning.
* Offer an innovative remedial mathematics program accommodating various skill levels.
* Develop and provide courses relevant to the career and professional degree programs of the college.
* Prepare students with strong content knowledge in chemistry and physics with emphasis on critical thinking and problem-solving skills, which will allow them to meet career goals.
* Offer transferable courses in astronomy and physical science that will meet general education requirements in science.
* Ensure supplementary student support through audiovisual materials and tutorial services.
* Provide academic advising to students with engineering majors and general studies.

**Program/Department Outcomes Achievement:**

**Goal 1: Provide freshman and sophomore-level course work which meets or exceeds the standards of public institutions of higher learning.**

The Math Department offers several classes that meet requirements for Area III of the articulation agreement between the Alabama Community College System and Alabama public four-year intuitions. The courses that fall under Area III include the following: Math 110, 112,

113, 120, 125, and 126. A review of the three-year academic cycle reveals the following about student progress and performance for the freshmen and sophomore level math courses:

**Math 110** - Overall 93.9% of students assessed are learning at level 2 or higher indicating overwhelming success in objective one concept instruction. Improvement of student learning toward level 4 is observed from 2016 to 2019. 84.6% of students assessed are learning at level 2 or higher for objective 2 or higher indicating students’ nearing success in learning objective two concepts, an increase of 16.4% from the 2013-2016 reporting cycle. An increase in student success (+ 2.1%) was observed for the 201-18 academic year. However, that number decreased in 2018-2019 by -3.7%. Overall, the level 4 percentages remained the same.

Student performance on Objective 3 reveals 61.2% of students assessed are learning at level 2 or higher indicating students’ difficulty in learning objective 3. This was an increase of +9.3% over the past 3-year reporting cycle. The success rate is steadily improving through subsequent academic years, especially in levels 3 and 4. Additional practice/examples will continue to be given in the classroom and videos will be implemented in the online classes to help complete the objective.

Students performance on Objective 4 reveals 77.9% of students assessed are learning at level 2 or higher. This was a slight decrease of -1.8% over the last reporting cycle. The success rate has increased significantly in level 3, going from 7.4% in 2013-16 to 12.6% for 2016-2019. PowerPoint lessons and video examples will remain for online classes

**MTH 112** – Students met the benchmark of 70% success in objective 1 of SLOs. The percentage of success for this objective for 2013-2016 was 68.5% but increased to 71.23% for 2016-2019.

Therefore, we will continue to use this objective and question in hopes of continuing the improvement we have demonstrated over the last three years.

The results show that student success for objective 2 was below the 70% threshold at 67.33%a decrease in student performance for objective 2 may have resulted from a change in questions that merged multiple objectives. Objective 3 indicated that student success was 69.01%, and objective 4 success rate was 84.79%, a slight decrease for the previous reporting period by less than 1%. These results indicate that there is a need to keep the objective and to modify the question. Current questions test a higher level of complexity that is not required to demonstrate targeted proficiency in this objective.

**Math 113** – Student data for objective 1 shows the number of students that scored at a level 0 increased to 9.4% 2017-2018 but decreased to 0% in 208-2019, which indicates that more students are attempting the problem and completing it. At the end of the three-year period, 83.6% of students scored at level 2 or higher for objective 1, surpassing our benchmark.

For objective 2, the percentage of students that met our benchmark, remained relatively the same from 95% in year 1 to 91.5% in year 2, to 91.3% in year 3. For objective 3, 91.8% of students placed at level 2 or higher in each year and over 86% of students recorded at level 2 or higher each year, therefore for objective 3, students consistently surpassed benchmark of 70%, with 95% year 1, 93.4% year 2, and 91.3% year 3. Objective 4 is taught toward the end of the semester and has consistently been lower in student’s success and assessment. Objective 4 had an overall 49.8% for the three-year period, and objective 5 had an overall 67.7% for the three-year period. The suggestions made by the faculty is finding more time in class and demonstrating more examples in presenting the concepts addressed in Objective 4 and 5, and to show how these concepts are used in real-world opportunities.

**Math 120** – Calculus and its applications is intended to give a broad overview of calculus and is taken primarily by students majoring in commerce and business administrations. On Objective 1, 64.4% of students assessed are learning at level 2 or higher, an increase of +8.7% since the last reporting cycle. However, online sections contained more students achieving level 4 indicating possible higher success in learning objective one concept. This may be a result of online course restructuring which included frequent online testing in addition to regular homework requirements. On Objective 2, 64.4% of students assessed are learning at level 2 or higher. The apparent increase in successful learning of this concept in the online courses is believed to be caused by the implementation of more frequent testing to help retain student understanding. Objective 3, 70.9% of students assessed are learning at level 2 or higher indicating near success in objective four concept instruction. Objective 4, 70.7% of students assessed are learning at level 2 or higher. Objective 5, 47% show students’ continued difficulty to learning objective 5 concepts.

Math 125-This course is the first of three courses in the core calculus sequence taken primarily by students in science, engineering, and mathematics. More than 70% of students met the criteria for success for objective 2. However, a comparison of the levels over the three-year period indicated the performance at level 4 fluctuated for the 2016-19 academic years with the highest student success in Objective 2. More than 70% of students met the criteria for success of objective 2, and future action will focus more intensely on simplification techniques review as a component of derivative calculations. More than 70% of students met the criteria for success for objective three also. Students that demonstrate high performance at the beginning of the course will consistently perform at the high level throughout the course.

Math 126 – Calculus 2 is the second course of our three sequence Calculus series. More than 70% of the students met criteria for success for objective 1, an increase of almost 20% points from 61% of the 2013-16 cycle to 80.7% for the current cycle. Many of the students had trouble with the process of U substitution; therefore, additional examples of this type will be given throughout the semester using this technique. More than 70% of students met the criteria for success for objective 2. Fewer than 70% of students met the criteria for success for objective 3. Additional emphasis on this topic may be required.

**Math 227** –The assessment rubric for the year 2016-19 was comprised of three objectives. Objective 1 shows 92% of students met the criteria for success. In Objective 2, 93% of students showed success. In Objective 3, 90% showed success. There is no need for change currently.

**Math 238** – Students met the criteria for success (+90%) in the Differential Equations course more than 90% of for success for all three objectives. No need for changes currently.

Students seem to be doing well on the fundamental techniques. This should allow us to push them a little harder in these and other areas.

**Math 265**- For each of the three objectives comparable student success trends are noted. The percentage of students that performed at level 0 decreased between year 2 and year three while the percentage of students that performed at level 1 increased for each objective. Faculty would like to see both levels reflect a drop-in percentage from year to year. A drop in one level of assessment always will always reflect a rise in another level. Faculty were encouraged to introduce strategies to increase the percentage of students that performed at level 4. The method of testing in these statistics, courses are different from the testing methods of other math courses. The tests are given online, and the students can use their formulas and their notes.

Goal 2: Offer mathematics program accommodating various skill levels.

All colleges within the Alabama Community College system are required to provide developmental courses to students who are in need additional academic preparation before enrolling in college level courses. The Math department offers one developmental course, MTH 098. MTH 090 was dropped from the Alabama Community College system courses in fall 2018. As noted in the course format data, students have the option to enroll in traditional or internet courses. In Fall 2018, students who obtain assessment scores that would place them in MTH 098 but are on the cusp of the next upper-level math course were given an opportunity to enroll in the upper-level math courses but were required to take a co-requisite math course with the upper-level courses. These courses allow students to receive targeted instruction which accelerates and reviews content from the lower level course and then presents the content in the designated upper-level course. The ACCS developed standardized plans of instruction for all developmental courses. During the fall of 2018, the math department adopted the standards issued by the state.

**MTH 090** -Results from the student learning outcomes for MTH 090 indicate that students reached the benchmark of 74% on level 2, Objective 1 for years 2016-17 & 2017-18. This objective assessed students’ ability to express a

composite number in its prime factored form. 85% and 83.5% of students were successful with objectives 2 and 3, respectively.

**MTH 098**- There have been some changes at the state level with MTH 098. In the fall of 2018, the curriculum changed for MTH 098, and MTH 090 was removed from the curriculum. The 2016-19 three-year cycle started with one set of SLOs; and in the fall of 2018, two of the SLOs changed due to the change at the state level. Objectives 1 and 3 remained the same through the 3-year cycle, and on average 85% of students performed at level 2 or higher on objective 1 while 76% reached this goal for objective 3. The level of success over the 3-year cycle for the latter objective rose from 67% to 78%. The success in part is due to an emphasis on that content, graphing a linear equation, after the results in year 1. Suggestions were made on how to improve instruction, and strategical implementation took place. Objectives 2 and 4 were changed in year 3(Fall 2018). The average number of students performing at level 2 or higher for objective 2 was around 83% prior to Fall 2018 as well as after. The results for objective 4 were the lowest of the SLOs. The level of success ranged from 62% to 70% in years one and two, and then once the SLO was changed in the Fall of 2018, the level of success was 65%. The department will research best practices for instruction on the content and implement strategies for success.

**Goal 3: Develop and provide courses relevant to the career and professional degree programs of the college.**

Students have the option to take either Math 100 or MTH 116 for many of the career and professional degree programs. These two courses can satisfy the three hours necessary to fulfill of Area III requirements. Currently, the career and professional programs that require students to take one of these courses include the following:

• Business Management

• Child Development

• Fire Science

• Funeral Services

• Hospitality Management

• Law Enforcement

• Medical Laboratory

• Office Administration Technology

**Math 100**- This course has the largest number of course offerings in the mathematics department. Results from the student learning outcomes show that students were above 70% for all objectives for the three-year summary. This improvement over the last three years is greatly due to having Math Tutors in a Math Lab on all four campuses providing help for all students. For objective 1, 78.8% of students performed at Level 2 or higher on average over the three-year period. For objective 2, 79.1% of students performed at level 2 or higher on average over the three-year period, and for objective 3, 75.1% of students performed at level 2 or higher on average over the three-year period. Two additional objectives were added since the last three-year review. Objective 4, 77.5% performed at level 2 or higher. Objective 5, 87.9% performed at level 2 or higher. Overall, 79.68% of students performed at Level 2 or higher on average over the three-year period.

Math 116 – Mathematical Applications provides practical applications of mathematics and includes selected topics from consumer math and algebra. This is a terminal course designed for students seeking an associate in applied science degree and does not meet the general core requirement for mathematics. Objective 1 required students to use algebraic skills to solve a linear equation in one variable. 26.7% failed to produce a correct answer, mostly due to the error in a sign or arithmetic calculation. This down from the previous 3-year assessment of 37%. Objective 2 required students to calculate the volume of a solid container. Overall success for this objective is high at 87.7%, with 223/254 students scoring at level 2 or higher. However, the number of students who produce a correct answer (level 4) is low at 59.06%. However, level 4 is drastically higher this reporting period than the previous 3-year reporting. Objective 3 required

students to calculate the percentage and as with objective 1 and objective 2, a high percentage of student scored at level 2 or higher was 88.98%. This is up from the last reporting when only 73.3% of students performed at level 2 or higher. Considering that calculators can be used during testing, future focus will be on increasing the number of lecture examples presented and increase in homework assignments.

**Goal 4: Prepare students with strong content knowledge in chemistry and physics with emphasis on critical thinking and problem-solving skills, which will allow them to meet career goals.**

Students have the option to take chemistry and physics courses to fulfill Area V requirements for specific majors. The college offers chemistry and physics sequences for both major and non-major students. Chemistry 104 and 105 are the non-major’s chemistry courses and are available in both the traditional and online formats.

**Chemistry 104-** Students demonstrated an understanding of converting temperatures between Fahrenheit, Celsius, and Kelvin scales by demonstrating 83% success at a level two or higher and 75% performed at a level of 3 or higher for objective one. A slight decrease is performance was noted for the 2015-2016 academic year. A change in the assessment format for online students (online to the on-campus exam) is believed to be the cause of the decrease with a 13% (81% to 68%) difference when comparing the previous year results.

The Objective two student learning outcome requires the student to understand and demonstrate how to calculate density, mass, or volume of an object. Over the 3-year assessment period, 77% performed at level 2 or better, and 73 % performed at level 3 or higher. The noted decrease in student performance (-9%) may be contributed to combining the internet and traditional students for the SLO assessment. Results from 2013-2014 were the highest with 75% of students performed at a level 2 or greater. The students in the cohort were online students when compared to subsequent years which contained both internet and traditional students.

Student performance on objective 3 was the lowest when compared to objectives 1 and 2. Only 56% of students were successful at a level of 2 or higher demonstrating an understanding of combining the gas law to find the volume of gas when both temperature and pressure change. To improve student success, mandatory homework assignments were incorporated for the 2014-2015 academic year, and the student showed improvement (+15). However, this gain was lost once online students were required to come on campus to complete their student learning outcome assessment.

Chemistry 105 – This course is only taught during the summer session, because many students are transients. An average of 90 % of students consistently performed at the level of 2 or higher over the 3-year evaluation period. 98% percent of students demonstrated an understanding of isomers when given the molecular to draw and name. Objective 2 showed a success rate of 82%, and Objective 3 showed student success at 82%.

**Chemistry 111**- Seventy percent of students demonstrated success (> 70%) on the majority of the objectives for this course. However, 84% the students demonstrated an understanding of chemistry using freezing point depression data to determine the molar mass of a substance at a level of two or higher (Objective 7). This is an increase of 19% points over the past three-year review. This objective requires students to not only understand the mathematical steps but also think critically about the chemical process. Faculty put more emphasis on this concept in the laboratory to improve student outcomes.

**Chemistry 112** - It is necessary for students who enroll in this course to have a firm foundation from the prerequisite course as well as in mathematics. Students are required to demonstrate their abilities to analyze and solve chemical equations consistently. For example, Objective 1 requires the student to predict the direction in which a system at equilibrium will shift when under stress. Every year greater than 90% of students performed at a level 2 or higher.

80%+ of students scored at a level 2 or higher on objective 2, 3 and 4, the content assessed in these objectives may have been more difficult when compared to students who performed at a level two or higher on Objectives 1 (91%) and 2 (89%).

**Chemistry 221**- This course typically has a small student enrollment and as a result, a low student- instructor ratio. The low ratio increases opportunities for one-on-one interactions which allows for targeted instruction. The 2016-19 data for Objectives 1 and 2 is significantly higher when compared to subsequent years because students were only assessed on three levels. Once the grading rubric was modified and students had an opportunity to receive partial credit the number of students demonstrating success improved. A comparison of student success across all objectives reveals students showed a better understanding of Objectives 1 and 3 with 96% and 100% scoring at a level two of higher overall for the three-year period. During the 2016-19 academic years 86% of students successfully demonstrated an understanding of synthesizing structures for compounds based on data obtained from NMR, IR, and mass spectra.

**Chemistry 222** - Students are expected to have a solid foundation in chemistry and mathematical before enrolling in the course. Faculty recognized it was necessary to conduct a preliminary assessment of student strengths and deficits as they relate to prerequisite content. Therefore, objective 1 evaluated students’ abilities to demonstrate an understanding of basic organic chemistry concepts. 92% of students performed at a level 2 or higher. Success was demonstrated on objectives 2 and 3 with 96% of students scoring at levels 2 or higher for both objectives. Instructor feedback supports a change in the textbook, small class sizes, and required homework are all contributing factors to student achievement.

The college offers two-course sequences which provide students with an option to enroll in either Trigonometry (201/202) or Calculus I (213S) and II (214S) Physics based on their career and educational goals.

Physics 201- Overall, most Physics 201 students demonstrated an understanding of Newton’s Law (68.8%) energy and momentum (65.6%), and Archimedes’ Principle (53.6%) scoring at level 2 or higher, a decrease of -16.4% since the last reporting cycle. There are opportunities for improvement across all three objectives. Faculty will place more emphasis on foundational content and improve students’ understanding of multi-step problems.

**Physics 202**- (Offered Spring 2018)

Overall, one section was assessed. 53.8% of students demonstrated an understanding of Objective 1; 60% on objective 2; 40% on objective 3; and 100% on objective 4.

**Physics 214S**- Over the three-year academic period show students successful with 70% scoring at levels two or higher across each on objectives 1 and 3.78% percent of students could demonstrate knowledge of electromagnetic, objective 1. 88% of students met the criteria for objective 2. 88% of student met the criteria for objective 3. Faculty determined more problems solving activities will be incorporated to improve students’ abilities to state and apply Newton’s 2nd Law. Results from Physics 214 reveal student were successful across all three objectives.

**Goal 5: Offer transferable courses in astronomy and physical science that will meet general education requirements in science**.

The MEP department offers both astronomy and physical science courses to non-science majors who need to meet their Area III requirement for transfer. Enrollment in the Astronomy course has increased over the past three years due to two major factors. First, Astronomy courses typically were taught by an adjunct instructor. A full-time instructor has been teaching the Astronomy course for the past three years. Secondly, the course moved entirely to an online format. A comparison of 2013-16enrollments to 2016-19 shows an 9% increase. Overall students successfully demonstrated an understanding of time scales for major cosmic events, the composition and dynamics of the universe, and the ability to describe the size and distance between planets, galaxies, or galaxy clusters in the universe. Objective 1, an average of 85% of students were successful at level 3, 83% in Objective 2, and 81% on Objective 3.



**Part 2: Program/Department Change**

Program/Department Goal Changes: No changes to Program/Department goals are warranted at this time.

**Course Student Learning Outcome Changes:**

In 2018, Math 090 was deleted from the state curriculum. Math 098 courses were increased from 3-hour courses to 4-hour courses. Also, in fall of 2018, a co-requisite (math 099) was paired with math 100 courses to help students who scored high enough on the math placement test to test out of math 098 but not enough for math 100. Students with this score are required to sign up for math 99. A committee comprised of representatives from system colleges reviewed course content for math courses in April 2019. The objectives and competencies represent the minimum requirement for all colleges across the state. Each college has autonomy to add additional material to the courses to meet entry level requirements for upper-level courses. A petition to change Objective 3/Math 098- Elementary Algebra was issued to reflect changes to course content. Students will be assessed on their ability to graph a linear equation instead of simplifying a rational expression.

**Part 3: Evidence of Staff Participation in Program Review**

Faculty/staff participation: Describe the faculty and/or staff who participated in this program review and the role they played. Include specific dates for meetings held or activities conducted.

Select faculty are assigned to collect and analyze the data for specific courses. However, all faculty in the Math, Engineering, and Physical Science Department participate in the evaluation of the results and assist in making recommendations. The department met periodically throughout the three-year period to discuss the data.

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| **Subj** | | **Crse** | | **Title** | | **Instructor** |
| **AST** | | **220** | | **Introduction to Astronomy** | | **Robert O Wallace** |
| **CHM** | | **104** | | **Introduction to Inorganic Chemistry** | | **Charlotte S Lyons** |
| **CHM** | | **105** | | **Introduction to Organic Chemistry** | | **Charlotte Lyons** |
| **CHM** | | **111** | | **College Chemistry I** | | **Lisa Alexandria Nagy** |
| **CHM** | | **112** | | **College Chemistry II** | | **Lisa Alexandria Nagy** |
| **CHM** | | **221** | | **Organic Chemistry I** | | **Lisa Alexandria Nagy** |
| **CHM** | | **222** | | **Organic Chemistry II** | | **Lisa Alexandria Nagy** |
|  | | | | | | |
| **MTH** | | **090** | | **Basic Mathematics** | | **Nanette Easterling/Jarrod Cunningham** |
| **MTH** | | **098** | | **Elementary Algebra** | | **Nanette Easterling/ Jarrod Cunningham** |
| **MTH** | | **099** | | **Co-Requisite for MTH 100** | | **Jeff Darby/ Sabrina Moore** |
| **MTH** | | **100** | | **Intermediate College Algebra** | | **Jeff Darby/Sabrina Moore** |
| **MTH** | | **110** | | **Finite Mathematics** | | **Sam White** |
| **MTH** | | **112** | | **Precalculus Algebra** | | **Yu-Ing Hargett/ Margaret Thrasher** |
| **MTH** | | **113** | | **Precalculus Trigonometry** | | **Louise Hall** |
| **MTH** | | **116** | | **Mathematical Applications** | | **Konstantinos Theodorou** |
| **MTH** | | **120** | | **Calculus and its Applications** | | **Samuel White/ Louise Hall** |
| **MTH** | | **125S** | | **Calculus I** | | **Konstantinos Theodorou** |
| **MTH** | | **126S** | | **Calculus II** | | **Konstantinos Theodorou** |
| **MTH** | | **227** | | **Calculus III** | | **Robert O Wallace** |
|  | |  | |  | |  |
| **MTH** | | **238** | | **Applied Differential Equations I** | | **Robert O Wallace** |
| **MTH** | | **265** | | **Elementary Statistics** | | **Konstantinos Theodorou** |
|  | | | | | | |
| **PHS** | **111** | | **Physical Science I** | | **Charlotte S Lyons** | |
| **PHS** | **112** | | **Physical Science II** | | **Charlotte S Lyons** | |
|  | | | | | | |
| **PHY** | **201** | | **General Physics I-Trig Based** | | **Aliakbar Rismanchi Yazdi (P)** | |
| **PHY** | **202** | | **General Physics II Trig-Based** | | **Aliakbar Rismanchi Yazdi (P)** | |
| **PHY** | **213S** | | **General Physics with Calculus I** | | **Robert O Wallace (P)** | |
|  | | | | | | |
| **PHY** | **214S** | | **General Physics with Calculus II** | | **Robert O Wallace (P)** | |
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|  |  |  | **Assessment Record** |
| **Program:** | **Mathematics, Engineering, Physical Sciences** | **Assessment period:** | **2016-2019** |

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| **Instructional Program Outcomes & Assessment Plan – AST 220**  **General Education Objective**  The student will demonstrate understanding of distance, time scales, and scientific principles needed to comprehend the fundamental ideas of astronomy. The student will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Department Outcomes**   * Provide freshman and sophomore-level courses in Chemistry, Mathematics, Physics, Physical Sciences, and Astronomy, with emphasis on critical thinking and analytical ability, that are transferable to public institutions of higher learning. * Offer an appropriate remedial mathematics program accommodating various skill levels. * Develop and provide courses relevant to the career and professional degree programs of the college.   **Astronomy Course Level Outcomes Assessment Rubric**  Level 3: Attempted Problem and Solved Correctly  Level 2: Attempted Problem and Did Not Solve Correctly  Level 1: Did Not Attempt Problem  **Evaluated Course Objectives**  The General Education Objective is met through the course objectives that require the use of analogy and scientific concepts to understand fundamental elements of astronomy. Student mastery of the specific course objectives to follow will be evaluated by analyzing answers to appropriate questions from the comprehensive final exam. The astronomy final will be a comprehensive multiple-choice exam.  The student will demonstrate knowledge of astronomy by his/her ability to:   1. Use analogy to describe size and distance scales between planets in the solar system, distance between star systems in galaxies, and distance between galaxies or galaxy clusters within the universe. 2. Be to describe the time scales for major cosmic events such as the age of the universe, when galaxies began to form, or when our solar system formed. 3. Demonstrate knowledge of basic scientific principles used by astronomers to understand the composition and the dynamics of the universe. | | | | | | | | |
| **Intended Outcomes** | | | **Means of Assessment** | **Criteria for Success** | | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| AST 220 Objective 1  The student will demonstrate knowledge of astronomy by his/her ability to use analogy to describe size and distance scales between planets in the solar system, distance between star systems in galaxies, and distance between galaxies or galaxy clusters within the universe. | | | Rubric based assessment of a related common final exam problem that fits the description given in objective 1 | 70% of students learning at a rubric level of 3 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 1 | 3% | 3% | 4% | 3% | | Level 2 | 15% | 13% | 8% | 12% | | Level 3 | 82% | 84% | 88% | 85% | | | Approximately 85% of students met the criteria for success for objective 1 which is the same as for the last 3-year summary. No need for changes at this time. Tests are based on material covered in class and reinforced by the reading assignments and the labs. |
| AST 220 Objective 2  The student will demonstrate knowledge of astronomy by his/her ability to be to describe the time scales for major cosmic events such as the age of the universe, when galaxies began to form, or when our solar system formed. | | | Rubric based assessment of a related common final exam problem that fits the description given in objective 2 | 70% of students learning at a rubric level of 3 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 1 | 3% | 3% | 4% | 3% | | Level 2 | 18% | 15% | 9% | 14% | | Level 3 | 79% | 82% | 87% | 83% | | | Approximately 83% of students met the criteria for success for objective 2, down slightly from 87% on the last 3-year summary. No need for changes at this time. Tests are based on material covered in class and reinforced by the reading assignments and the labs. |
| AST 220 Objective 3  The student will demonstrate knowledge of astronomy by his/her ability to demonstrate knowledge of basic scientific principles used by astronomers to understand the composition and the dynamics of the universe. | | | Rubric based assessment of a related common final exam problem that fits the description given in objective 3 | 70% of students learning at a rubric level of 3 | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level `1 | 3% | 3% | 4% | 3% | | Level 2 | 19% | 17% | 11% | 16% | | Level 3 | 78% | 80% | 85% | 81% | | | Approximately 81% of students met the criteria for success for objective 3 down slightly from 84% on the last 3-year summary. No need for changes at this time. Tests are based on material covered in class and reinforced by the reading assignments and the labs. |

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| **Instructional Program Outcomes & Assessment Plan – CHM105**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate knowledge of chemistry by his/her ability to  1. Using structural formulas, draw and name three isomers when given the molecular formula.  2. Given a Fischer structure of a monosaccharide, draw both α – and β- Haworth structures  3. Show how α-amino acids form peptide linkages. | | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 105 Objective 1  The student will demonstrate knowledge of chemistry by his/her ability to, using structural formulas, draw and name three isomers when given the molecular formula. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 5% | 0% | 0% | 2% | | Level 2 | 0% | 0% | 16% | 5% | | Level 3 | 14% | 25% | 32% | 23% | | Level 4 | 81% | 75% | 53% | 70% | | N= | 21 | 20 | 19 | 60 | | Success | 95% | 100% | 100% | 98% | | | Over the 3-year assessment period, 98% performed at level 2 or better.  In every year the criterion for success was met.  We continue to use assigned online homework, with a high completion rate.  This concept is tested often during the semester. |
| CHM 105 Objective 2  The student will demonstrate knowledge of chemistry by his/her ability to, given a Fischer structure of a monosaccharide, draw both **α** – and **β**- Haworth structures | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 15% | 0% | 5% | | Level 1 | 15% | 15% | 0% | 10% | | Level 2 | 0% | 15% | 16% | 10% | | Level 3 | 10% | 15% | 11% | 12% | | Level 4 | 76% | 40% | 63% | 60% | | N= | 21 | 20 | 19 | 60 | | | Over the 3-year assessment period, 82% performed at level 2 or better.  The criterion for success was met every year. Because this concept is taught at the end of the semester, some students have more trouble than with other concepts. In the next assessment period, we plan to use molecular models in a lab exercise to reinforce this concept. |
| CHM 105 Objective 3  The student will demonstrate knowledge of chemistry by his/her ability to show how α-amino acids form peptide linkages. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 15% | 10% | 21% | 15% | | Level 2 | 0% | 10% | 11% | 7% | | Level 3 | 10% | 25% | 1% | 12% | | Level 4 | 76% | 55% | 63% | 67% | | N= | 21 | 20 | 19 | 60 | | | This question assesses problem solving and critical thinking skills  Over the 3-year assessment period, 82% performed at level 2 or better.  The criterion for success was met every year. This topic also arises late in the semester, and we plan to add a modeling unit to improve student understanding. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. This class is taught only in the summer session, because a large majority of the students are transients who are already at a 4-year institution. CHM 105 is required for several majors and is intended for sophomores, but most students put off the class until later in their college careers. Many of the students who come to us already attempted the course elsewhere without success. The key to fostering success in this course is to give students clear tasks and expectations, stressing the learning objectives, and urging the students to stay on schedule. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa A. Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM111**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Carry out calculations relating density, specific gravity, mass, and volume to one another  2. Determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass.  3. Given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated.  4. Use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature.  5. Draw the Lewis structure of a molecule or ion and predict its geometry.  6. Draw valid resonance structures including formal charges.  7. Use freezing point depression data to determine the molar mass of a substance. | | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 111 Objective 1  The student will demonstrate his/her understanding of chemistry by being able to carry out calculations relating density, specific gravity, mass, and volume to one another | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 1% | 0% | 0% | | Level 1 | 4% | 5% | 2% | 4% | | Level 2 | 7% | 3% | 4% | 5% | | Level 3 | 14% | 16% | 7% | 12% | | Level 4 | 74% | 75% | 88% | 79% | | N= | 135 | 77 | 123 | 335 | | Success | 95% | 94% | 99% | 96% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  This question involves a concept that students perform in the lab. The mathematics are very simple.  In most sections, we have been using online homework, and give a preliminary math exam to the students on the first day. We assign extra online math problems to the students who show serious deficits. |
| CHM 111 Objective 2  The student will demonstrate his/her understanding of chemistry by being able to determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 3% | 1% | 95% | 4% | | Level 1 | 10% | 6% | 6% | 7% | | Level 2 | 13% | 12% | 15% | 13% | | Level 3 | 16% | 21% | 33% | 23% | | Level 4 | 59% | 60% | 41% | 53% | | N= | 135 | 77 | 123 | 335 | | Success | 88% | 93% | 89% | 89% | | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is a somewhat complex problem, and we go over it at length in all sections. It involves putting together several concepts. Although the steps to solve it can be memorized, student performance reflects their critical thinking abilities |
| CHM 111 Objective 3  The student will demonstrate his/her understanding of chemistry by being able to given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 2% | 1% | 2% | 2% | | Level 1 | 8% | 6% | 7% | 7% | | Level 2 | 7% | 6% | 19% | 11% | | Level 3 | 13% | 22% | 18% | 17% | | Level 4 | 70% | 64% | 54% | 63% | | N= | 135 | 77 | 123 | 335 | | Success | 90% | 92% | 91% | 91% | | | Over the 3-year assessment period, 91% performed at level 2 or better.  In every year the criterion for success was met.  Most students make only minor errors on this problem. The concept of solution stoichiometry and limiting reagent is introduced early in the semester.  Over the three years of the study, online homework stressing this type of problem has been used in most sections. Students who complete the homework perform better in exams. |
| CHM 111 Objective 4  The student will demonstrate his/her understanding of chemistry by being able to use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 2% | 1% | | Level 1 | 13% | 3% | 3% | 7% | | Level 2 | 8% | 6% | 7% | 7% | | Level 3 | 13% | 16% | 7% | 11% | | Level 4 | 65% | 73% | 81% | 73% | | N= | 135 | 77 | 123 | 335 | | Success | 86% | 95% | 95% | 91% | | | Over the 3-year assessment period, 91% performed at level 2 or better.  In every year the criterion for success was met.  This problem involves rather simple arithmetic and a low level of critical thinking. Many students who make errors in this problem have trouble using their calculators correctly (use of scientific notation and parentheses)  We have addressed this issue during the assessment period by having frequent calculator exercises in class. |
| CHM 111 Objective 5  The student will demonstrate his/her understanding of chemistry by being able to draw the Lewis structure of a molecule or ion and predict its geometry. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 2% | 1% | | Level 1 | 5% | 4% | 0% | 3% | | Level 2 | 3% | 4% | 7% | 5% | | Level 3 | 11% | 14% | 10% | 11% | | Level 4 | 80% | 75% | 81% | 79% | | N= | 135 | 77 | 123 | 335 | | Success | 94% | 93% | 98% | 96% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  Most students are able to draw the structure correctly in the exam, because they have to complete several similar problems in the online homework. |
| CHM 111 Objective 6  The student will demonstrate his/her understanding of chemistry by being able to draw valid resonance structures including formal charges | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 5% | 3% | | Level 1 | 20% | 4% | 5% | 11% | | Level 2 | 4% | 5% | 10% | 7% | | Level 3 | 23% | 29% | 20% | 23% | | Level 4 | 52% | 60% | 61% | 57% | | N= | 135 | 77 | 123 | 335 | | Success | 79% | 94% | 91% | 87% | | | Over the 3-year assessment period, 87% performed at level 2 or better.  In every year the criterion for success was met.  Most students are able to draw at least one of the two structures correctly in the exam, but either err in the assignment of charges, or in drawing the second structure. |
| CHM 111 Objective 7  The student will demonstrate his/her understanding of chemistry by being able to use freezing point depression data to determine the molar mass of a substance | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 10% | 3% | 11% | 9% | | Level 1 | 10% | 4% | 7% | 7% | | Level 2 | 7% | 3% | 16% | 9% | | Level 3 | 19% | 22% | 24% | 21% | | Level 4 | 56% | 69% | 41% | 53% | | N= | 135 | 77 | 123 | 335 | | Success | 82% | 94% | 81% | 84% | | | Over the 3-year assessment period, 84% performed at level 2 or better.  In every year the criterion for success was met.  This is a rather complex problem. It involves 4 steps. Although the steps to solve it can be memorized, student performance reflects critical thinking abilities This problem is taught during the last week of classes, and also is presented as a lab. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. In CHM 111, the key to success in the course is completion of a great deal of homework. Most sections that are taught at Jefferson State have mandatory online homework as part of the course grade. Students who complete most of the homework problems have success in the course, earning A’s and B’s. Many students resist buying the online homework because of the cost ($120/year), and some instructors resist requiring the online homework for the same reason, but there seems to be no other clear way to encourage completion of homework. While our students are required to have completed MTH 112 as a prerequisite, more than half of the students enter the class unprepared for simple algebra and exponents, based on their performance on an initial math assessment (MTH 100 level). Also, though this course is intended for students with a strong background in science and mathematics, about one fourth have not had high school chemistry. These students generally have problems with the class. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM112**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Use Le Chatelier's Principle to predict the direction in which a system at equilibrium will shift (if it does) when stresses are applied.  2. Predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical.  3. Determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb  4. For a given redox reaction, use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species. |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 112 Objective 1  The student will demonstrate his/her understanding of chemistry by being able to use Le Chatelier's Principle to predict the direction in which a system at equilibrium will shift (if it does) when stresses are applied. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 3% | 0% | 1% | | Level 1 | 7% | 4% | 10% | 8% | | Level 2 | 10% | 3% | 10% | 7% | | Level 3 | 12% | 22% | 27% | 23% | | Level 4 | 71% | 69% | 52% | 60% | | N= | 41 | 74 | 77 | 192 | | Success | 93% | 94% | 89% | 91% | | | Over the 3-year assessment period, 91% performed at level 2 or better.  In every year the criterion for success was met.  This is a qualitative question that assesses understanding of a basic concept. We reinforce this concept with a laboratory exercise. |
| CHM 112 Objective 2  The student will demonstrate his/her understanding of chemistry by being able to predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 5% | 5% | 0% | 3% | | Level 1 | 12% | 4% | 9% | 8% | | Level 2 | 12% | 4% | 3% | 5% | | Level 3 | 20% | 24% | 23% | 23% | | Level 4 | 51% | 62% | 65% | 61% | | N= | 41 | 74 | 77 | 192 | | Success | 83% | 90% | 91% | 89% | | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is another qualitative question that assesses understanding of a basic concept. We reinforce this concept with a laboratory exercise.  For most students, any difficulty arises from the sign convention. |
| CHM 112 Objective 3  The student will demonstrate his/her understanding of chemistry by being able to determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 2% | 6% | 6% | 5% | | Level 1 | 10% | 4% | 6% | 6% | | Level 2 | 10% | 4% | 6% | 6% | | Level 3 | 20% | 19% | 17% | 18% | | Level 4 | 59% | 69% | 64% | 65% | | N= | 41 | 74 | 77 | 192 | | Success | 89% | 92% | 87% | 89% | | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is a multi-step question that assesses ability to complete a complex calculation. We reinforce this concept with a laboratory exercise. |
| CHM 112 Objective 4  The student will demonstrate his/her understanding of chemistry by being able to use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 5% | 4% | 8% | 6% | | Level 1 | 10% | 5% | 5% | 6% | | Level 2 | 10% | 5% | 3% | 5% | | Level 3 | 17% | 20% | 22% | 20% | | Level 4 | 59% | 65% | 62% | 63% | | N= | 41 | 74 | 77 | 192 | | Success | 86% | 91% | 87% | 88% | | | Over the 3-year assessment period, 88% performed at level 2 or better.  In every year the criterion for success was met.  We reinforce this concept with a laboratory exercise and parameterized homework problems. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. In addition, we see improvement in the percentages of students achieving at level 3 or better. As in CHM 111, the key to success in the course is completion of a great deal of homework. During the 3-year assessment period, we introduced more analytical laboratories with quantitative data analysis. This was made possible by the purchase of automated laboratory data collection instrumentation. We hope to be able to continue improving the laboratory experience with this equipment. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM221**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Locate chirality centers, assign priorities to substituents, and assign R, S designations to chirality centers.  2. Propose structures for compounds, given their NMR, IR, and mass spectra  3. Calculate the degree of unsaturation of any compound, including those containing N, O, and halogens. |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 221 Objective 1  The student will demonstrate knowledge of organic chemistry by his/her ability to locate chirality centers, assign priorities to substituents, and assign R, S designations to chirality centers. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 13% | 0% | 15% | 10% | | Level 2 | 0% | 0% | 0% | 0% | | Level 3 | 25% | 25% | 38% | 31% | | Level 4 | 63% | 75% | 46% | 59% | | N= | 8 | 8 | 13 | 29 | | Success | 88% | 100% | 84% | 90% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  This is a qualitative question that assesses spatial ability as well as understanding of the rules of chirality  Because this is a small class, we are able to effectively discuss and practice these types of problems |
| CHM 221 Objective 2  The student will demonstrate knowledge of organic chemistry by his/her ability to propose structures for compounds, given their NMR, IR, and mass spectra | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 13% | 0% | 3% | | Level 1 | 13% | 0% | 15% | 10% | | Level 2 | 0% | 0% | 15% | 7% | | Level 3 | 25% | 25% | 39% | 31% | | Level 4 | 63% | 63% | 31% | 48% | | N= | 8 | 8 | 13 | 29 | | Success | 88% | 88% | 85% | 86% | | | Over the 3-year assessment period, 86% performed at level 2 or better.  In every year the criterion for success was met.  This question assesses problem solving and critical thinking skills  The small class size allows discussion of the problems, and assignment of parameterized homework encourages practice. |
| CHM 112 Objective 3  The student will demonstrate knowledge of chemistry by his/her ability to calculate the degree of unsaturation of any compound, including those containing N, O, and halogens. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 0% | 0% | 0% | 0% | | Level 2 | 0% | 0% | 0% | 0% | | Level 3 | 0% | 0% | 23% | 10% | | Level 4 | 100% | 100% | 77% | 90% | | N= | 8 | 8 | 13 | 29 | | Success | 100% | 100% | 100% | 100% | | | Over the 3-year assessment period, 100% performed at level 2 or better.  In every year the criterion for success was met.  This is an arithmetic question that assesses use of a general formula.  This concept is reviewed frequently during the semester. The small class size enables discussion. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. Over the assessment period, we changed textbooks from McMurry to another author, Brown, because it had better explanations of kinetics and thermodynamics. Unfortunately, the homework problems were not as rigorous as in the previous text. The new edition of the McMurry book, adopted this year, has improved the treatment of these topics while maintaining challenging end-of-chapter problems. The size of this class is very small, and most of the students live closer to the Shelby campus, and would prefer that the course be taught there. We continue to try to actively recruit for this course. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM222**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Calculate dissociation constants of carboxylic acids, and predict the relative acidities of substituted carboxylic acids.  2. Predict the products of carbonyl condensation reactions.  3. Use carbonyl condensation reactions in synthesis |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 222 Objective 1  The student will demonstrate knowledge of organic chemistry by his/her ability to calculate dissociation constants of carboxylic acids, and predict the relative acidities of substituted carboxylic acids. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 0% | 17% | 11% | 8% | | Level 2 | 10% | 0% | 22% | 12% | | Level 3 | 60% | 0% | 33% | 36% | | Level 4 | 30% | 83% | 33% | 44% | | N= | 10 | 6 | 9 | 25 | | Success | 100% | 83% | 88% | 92% | | | Over the 3-year assessment period, 92% performed at level 2 or better.  In every year the criterion for success was met.  This question assesses retention of material presented in CHM 112. |
| CHM 222 Objective 2  The student will demonstrate knowledge of chemistry by his/her ability to predict the products of carbonyl condensation reactions | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 30% | 0% | 22% | 20% | | Level 2 | 10% | 17% | 22% | 16% | | Level 3 | 20% | 17% | 22% | 20% | | Level 4 | 50% | 66% | 33% | 48% | | N= | 10 | 6 | 9 | 25 | | Success | 80% | 100% | 77% | 84% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  This question assesses problem solving and critical thinking skills  The small class size allows discussion of the problems, and assignment of parameterized homework encourages practice. |
| CHM 222 Objective 3  The student will demonstrate knowledge of chemistry by his/her ability to use carbonyl condensation reactions in synthesis | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 10% | 17% | 22% | 14% | | Level 2 | 10% | 0% | 33% | 14% | | Level 3 | 50% | 17% | 33% | 31% | | Level 4 | 30% | 66% | 11% | 28% | | N= | 10 | 10 | 9 | 29 | | Success | 90% | 83% | 77% | 72% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  This question assesses problem solving and critical thinking skills  The small class size allows discussion of the problems, and assignment of parameterized homework encourages practice. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. Over the assessment period, we changed textbooks from McMurry to another author, Brown, because it had better explanations of kinetics, thermodynamics and acidities. Unfortunately, the homework problems were not as rigorous as in the previous text. The new edition of the McMurry book, adopted this year, has improved the treatment of these topics while maintaining challenging end-of-chapter problems. The size of this class is very small, and most of the students live closer to the Shelby campus, and would prefer that the course be taught there. We continue to try to actively recruit for this course. Over the assessment period, we have been working hard with the students to make sure that they engage with the material and do the homework, but recently, students seem unwilling to spend time together outside of class working problems, and they seem to have no time to come in for extra help because of their work schedules. In such a small class, the levels of academic preparation can vary greatly from year to year. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan - MTH 090**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective:**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives:**  The student will demonstrate his/her ability to make very basic applications of the arithmetic and algebraic skills taught in this course by being able to:  1. Express any given composite number in its prime factored form.  2. Apply the order of operations agreement to computations involving more than one operation.  3. Evaluate algebraic expressions using given numerical values. |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 090 Objective 1  The student will demonstrate his/her ability to make very basic applications of the arithmetic and algebraic skills taught in this course by being able to express any given composite number in its prime factored form. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 |  | Total  2016-2018 | | Level 0 | 13% | 17.5% |  | 15% | | Level 1 | 11.3% | 10.8% |  | 11% | | Level 2 | 10% | 11.7% |  | 11% | | Level 3 | 13.4% | 16.7% |  | 15% | | Level 4 | 52.3% | 43.3% |  | 48% |   Total #: 239 120  Level 2 and Above  Met 76.7% 71.7 % 74 %  Not Met 23.3% 28.3% 26 % | Due to changes at the state level, MTH 090 was not offered during the 2018-2019 academic year. It was removed from the Community College Curriculum. Also note that data was not recorded for the Pell City campus for 2017-18.  \*74% of students performed at Level 2 or higher on average over the 2 year period. |
| MTH 090 Objective 2  The student will demonstrate his/her ability to make very basic applications of the arithmetic and algebraic skills taught in this course by being able to apply the order of operations agreement to computations involving more than one operation. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 |  | Total  2016-2018 | | Level 0 | 6% | 6% |  | 6% | | Level 1 | 11% | 8% |  | 10% | | Level 2 | 17% | 22% |  | 20% | | Level 3 | 30% | 26% |  | 28% | | Level 4 | 36% | 38% |  | 37% |   Total #: 239 120  Level 2 and Above  Met 83% 86% 85%  Not Met 17% 14% 15% | \*85% of students performed at Level 2 or higher on average over the 2 year period. |
| MTH 090 Objective 3  The student will demonstrate his/her ability to make very basic applications of the arithmetic and algebraic skills taught in this course by being able to evaluate algebraic expressions using given numerical values.  **Plan Submitted:** | Rubric based assessment of related common final exam problems  **September 24, 2019** | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 |  | Total  2016-2018 | | Level 0 | 6% | 12% |  | 9% | | Level 1 | 8% | 7% |  | 7.5% | | Level 2 | 18% | 15% |  | 16.5% | | Level 3 | 21% | 18% |  | 19.5% | | Level 4 | 47% | 48% |  | 47.5% |   Total #: 239 120  Level 2 and Above  Met 86% 81% 83.5%  Not Met 14% 19% 16.5%  **Plan Submitted by:** | 83.5% of students performed at Level 2 or higher on average over the 2 year period.  Nanette Easterling |

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| **Instructional Program Outcomes & Assessment Plan - MTH 098**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives (For Fall 2016-Spring 2018)**  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to:  1. Solve linear equations, including literal, by applying the properties of equality.  2. Apply the rules of exponents to quantities involving integer exponents.  3. Graph a linear equation.  4. Factor a trinomial  **Evaluated Course Objectives (For Fall 2018-Spring 2019)**  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to:  1**.** Solve linear equations, including literal, by applying the properties of equality.  2. Evaluate an algebraic expression using given numerical values  3. Graph a linear equation.  4. Write the equation of a line given appropriate information. | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 098 Objective 1  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to solve linear equations, including literal, by applying the properties of equality. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 5% | 2% | 3% | 3% | | Level 1 | 13% | 11% | 12% | 12% | | Level 2 | 14% | 22% | 16% | 17% | | Level 3 | 22% | 23% | 20% | 23% | | Level 4 | 46% | 42% | 49% | 45% |   Total #: 553 295 416  Level 2 and Above  Met 82% 87% 85% 85%  Not Met 18% 13% 15% 15% | Overall, on average, 85% of the students are performing at Level 2 or higher.  Reflection/Implication: The intended success rate was met for Objective 1 and we will continue current instructional strategies. We will continue to inform students of the free tutoring service that is available on each campus as well. |
| MTH 098 Objective 2  (Fall 2016-Spring 2018)  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to apply rules of exponents to quantities involving integer exponents.  **(Fall 2018-Spring 2019)**  **The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to evaluate an expression given numerical values.** | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | **2018-2019** | Total  2016-2018 | | Level 0 | 6% | 3% | **3%** | 4.5% | | Level 1 | 19% | 17% | **8%** | 18% | | Level 2 | 22% | 31% | **12%** | 26.5% | | Level 3 | 24% | 16% | **17%** | 20% | | Level 4 | 29% | 33% | **60%** | 31% |   Total #: 553 295 416  Level 2 and Above  2016-17 2017-18 2018-19 Total  Met 85% 82% 82% 83.5%  Not Met 15% 18% 18% 16.5% | The SLO for Objective 2 changed in the Fall of 2018. The content involving the concept of the old objective 2, applying the rules of exponents to quantities involving integer exponents, was moved to MTH 100. Note the objective in the far left column in **bold** reflects the new objective 2 that was used in Fall of 2018-Spring of 2019.  The Total column to the right shows the total for 2016-2018; it does **NOT** include the 2018-19 year.  Overall, on average, around 83% of students are performing at Level 2 or higher (both old objective and the new one).  Reflection/Implication: The intended success rate was met for Objective 2 and we will continue current instructional strategies. We will continue to inform students of the free tutoring service that is available on each campus as well.  The column to the left represents the average total % of students who met the objective at level 2 or higher for each year. The total column includes only Fall of 2016-Spring 2018, it does **NOT** include Fall 2018-Spring 2019. |
| MTH 098 Objective 3  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to graph a linear equation.  MTH 098 Objective 4  (Fall 2016-Spring 2018)  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by factoring a trinomial.  **(Fall 2018-Spring 2019)**  **The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations writing the equation of a line given appropriate information.**  **Plan Submission Date: September 26, 2019** | Rubric based assessment of related common final exam problems  Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher  70% of students learning at a rubric level of 2 or higher  **Submitted by:** | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 13% | 7% | 9% | 10% | | Level 1 | 20% | 11% | 13% | 14% | | Level 2 | 12% | 16% | 13% | 14% | | Level 3 | 9% | 13% | 7% | 10% | | Level 4 | 46% | 53% | 58% | 52% |   Total #:553 295 416  Level 2 and Above  Met 67% 82% 78% 76%  Not Met 33% 18% 22% 24%   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | **2018-2019** | Total  2016-2018 | | Level 0 | 10% | 8% | **15%** | 9% | | Level 1 | 28% | 22% | **20%** | 25% | | Level 2 | 12% | 20% | **28%** | 16% | | Level 3 | 10% | 12% | **18%** | 11% | | Level 4 | 40% | 38% | **19%** | 39% |   Total #: 553 295 416  Level 2 and Above  Met 62% 70% 65% 66%  Not Met 38% 30% 35% 34%  **Nanette Easterling & Jarrod Cunningham** | Objective 3 has remained the same during the 3-year period. This is the first 3- year period, however, that this objective has been assessed. Note the increase from 67% (performing at level 2 or higher in 2016-17) to 78% in 2018-19. Even though there was a slight decrease from 2017-18 to 2018-19, the overall increase is substantial. After the first year the department reviewed best practices for the objective and implemented those to strive to increase the level of success.  Reflection/Implication: The intended success rate was met for Objective 2 and we will continue current instructional strategies. We will continue to inform students of the free tutoring service that is available on each campus as well.  The SLO for Objective 4 changed in the Fall of 2018. The content involving the concept of factoring trinomials, the previous Objective 4, was moved to MTH 100. The new objective 4 is writing the equation of a line given appropriate information. So, it is difficult to compare the results or progress of these 2 objectives because they are derived from 2 very different concepts.  The Total column to the right shows the total for 2016-2018; it does **NOT** include the 2018-19 year. Note the objective in the far left column in **bold** reflects the new objective 4 that was used in Fall of 2018-Spring of 2019.  The column to the left represents the average total % of students who met the objective at level 2 or higher for each year. The total column includes only Fall of 2016-Spring 2018, it does **NOT** include Fall 2018-Spring 2019.  Reflection/Implication: For this new objective we did not meet the goal of 70% performing at Level 2 or higher each year. The concept of writing the equation of a line is a challenging one for MTH 098 students. There are several steps involved and this particular problem involves the use of a slope that is a fraction. As a department we will discuss moving forward, best practices to implement in teaching this concept to aid in the success of our students. |

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| **Instructional Program Outcomes & Assessment Plan - MTH 100 and 099**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to:  1. Simplify radical expressions and perform operations with radical expressions.  2. Find the equation of a line given appropriate information. (2016/17 and 2017/18) Factor a trinomial. (2018/19)  3. Perform operations with rational expressions.  4. Use the quadratic formula to find solutions to equations.  5. Apply the rules of exponents to quantities involving integer exponents. | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 100 Objective 1  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to simplify radical expressions and perform operations with radical expressions | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 8.3% | 7.1% | 11.8% | 9.4% | | Level 1 | 12.5% | 16.0% | 8.4% | 11.8% | | Level 2 | 15.4% | 14.0% | 19.0% | 16.5% | | Level 3 | 11.3% | 13.2% | 11.4% | 11.8% | | Level 4 | 52.5% | 49.8% | 49.4% | 50.5% | | Total Students | 726 | 637 | 951 | 2314 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 79.2% | 77.0% | 79.8% | 78.8% | | Not Met | 20.8% | 23.0% | 20.2% | 21.2% | | 78.8% of students performed at Level 2 or higher on average over the 3 year period.  There was an overall increase of student success based on the criteria for the three years. The tutor and Smart Thinking significantly improved student success.  The introduction of MTH 099 in 2018/19 helped students who needed the support to be successful in the course. Their average was 75.0% performing at Level 2 or higher. |
| MTH 100 Objective 2 for 2016/2017 and 2017/2018  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to find the equation of a line when given appropriate information.  MTH 100 Objective 2 for 2018/2019  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to factor a trinomial. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2018 | | Level 0 | 5.0% | 6.0% | 5.6% | 5.4% | | Level 1 | 17.5% | 13.2% | 8.9% | 15.5% | | Level 2 | 21.6% | 16.5% | 19.2% | 19.2% | | Level 3 | 17.9% | 21.7% | 10.3% | 19.7% | | Level 4 | 38.0% | 42.7% | 55.9% | 40.2% | | Total Students | 726 | 637 | 951 | 1363 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 77.5% | 80.9% | 85.4% | 79.1% | | Not Met | 22.5% | 19.1% | 14.6% | 20.9% | | 79.1% of students performed at Level 2 or higher on average over the 2 year period of 2016-2018.  There was an increase of student success based on the criteria each year.  85.4% of students performed at Level 2 or higher in year 2018-2019 with the new objective. The use of results to provide more practice and examples and the tutor significantly improved student success.  The introduction of MTH 099 in 2018/19 helped students who needed the support to be successful in the course. Their average was 83.3% performing at Level 2 or higher. |
| MTH 100 Objective 3  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to perform operations with rational expressions  MTH 100 Objective 4  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to use the quadratic formula to find solutions to equations | Rubric based assessment of related common final exam problems  Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher  70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 4.5% | 8.9% | 13.5% | 9.4% | | Level 1 | 20.4% | 13.2% | 13.4% | 15.5% | | Level 2 | 15.8% | 18.5% | 26.5% | 21.0% | | Level 3 | 20.4% | 21.0% | 11.0% | 16.7% | | Level 4 | 38.8% | 38.3% | 35.6% | 37.4% | | Total Students | 726 | 637 | 951 | 2314 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | | | |  | |  |  |  |  |  | |  |  |  |  |  |   Level 2 and Above | | | |  | | Met | 75.0% | 77.8% | 79.4% | 75.1% | | Not Met | 25.0% | 22.2% | 27.6% | 24.9% |  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 8.1% | 10.5% | 7.3% | 8.4% | | Level 1 | 19.1% | 13.8% | 10.5% | 14.1% | | Level 2 | 17.2% | 19.0% | 20.6% | 19.1% | | Level 3 | 22.6% | 26.1% | 19.2% | 22.2% | | Level 4 | 32.9% | 30.6% | 42.4% | 36.2% | | Total Students | 726 | 637 | 951 | 2314 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 72.7% | 75.7% | 82.2% | 77.5% | | Not Met | 27.3% | 24.3% | 17.8% | 22.5% | | 75.1% of students performed at Level 2 or higher on average over the 3 year period. There was student success based on the criteria in each of the three years. The tutor and Smart Thinking made significant impact on improved student success. The introduction of MTH 099 in 2018/19 helped students who needed the support to be successful in the course. Their average was 25.0% performing at Level 2 or higher. The students in 099 struggled with this objective.  77.5% of students performed at Level 2 or higher on average over the 3 year period.  There was an increase of student success based on the criteria over the 3 years. The use of results to provide more practice and examples and the tutor significantly improved student success.  The introduction of MTH 099 in 2018/19 helped students who needed the support to be successful in the course. Their average was 50.0% performing at Level 2 or higher. These students struggled with this objective, also. |
| MTH 100 Objective 5  The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to apply rules of exponents to quantities involving integer exponents. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2018-2019 | | Level 0 |  |  | 6.5% | 6.5% | | Level 1 |  |  | 5.9% | 5.9% | | Level 2 |  |  | 23.0% | 23.0% | | Level 3 |  |  | 14.2% | 14.2% | | Level 4 |  |  | 50.7% | 50.7% | | Total Students |  |  | 951 | 951 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met |  |  | 87.9% | 87.9% | | Not Met |  |  | 12.1% | 12.1% | | 87.9% of students performed at Level 2 or higher. This objective was new for 2018/ 2019. The objective was previously in MTH 098. Students were familiar with the objective from MTH 098, leading to greater success in MTH 100. Also, the use of results to provide more practice and examples and the tutor significantly improved student success.  The introduction of MTH 099 in 2018/19 helped students who needed the support to be successful in the course. Their average was 100.0% performing at Level 2 or higher. |
| **Reflection/ Implications:** The intended success rates were met for each of the learning outcomes. Reflecting upon the data, one can see that 12.0% to 25.0% of students are not scoring at Level 2 or higher. Students who seem to struggle the most to meet the higher levels are online students and MTH 099 students. At the start of the Fall semester, the Math faculty met to train on implementing best practices in the MTH 099 courses so that the students will have the tools necessary to be successful in MTH 100 and the SLO objectives. Also, for internet-based courses, there are not many practice problems in the homework management system that reflect the SLO objectives. The Math faculty will need to search for more resources/ problems for students to practice so that they will be better prepared for the SLO objectives. Also, the professors of the internet-based courses could implement online webinars to cover more of the SLO objectives in a “live” manner, which allows for discussions with the students. | | | | |
| **Plan Submission Date:**  **September 27, 2019** |  |  | **Submitted by:**  **J. Brandon Darby** |  |

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| **Instructional Program Outcomes & Assessment Plan – MTH 110**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to  1. Perform basic algebraic operations on matrices  2. Use Venn diagram to solve a problem  3. Use Bayes’ Theorem to solve a problem  4. Compute the mean, variance, and standard deviation of a random variable | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 110 Objective 1  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to perform basic algebraic operations on matrices | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 4.8% | 1.6% | 1.5% | 2.6% | | Level 1 | 5.9% | 3.2% | 1.5% | 3.5% | | Level 2 | 4.8% | 1.0% | 2.9% | 2.9% | | Level 3 | 13.1% | 6.9% | 4.4% | 8.2% | | Level 4 | 71.4% | 87.3% | 89.7% | 82.8% | | Total Students | 168 | 189 | 68 | 425 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 89.3% | 95.2% | 97.0% | 93.9% | | Not Met | 10.7% | 4.8% | 3.0% | 6.1% | | Overall, 93.9% of students assessed are learning at level 2 or higher indicating overwhelming success in objective 1 concept instruction. Improvement of student learning toward level 4 is observed from 2016 to 2019. Continue current instructional methods which included in-class lectures and practice problems for on-campus sections and Power Point lessons as well as numerous written and video examples for online sections. |
| MTH 110 Objective 2  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to use Venn diagram to solve a problem | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 3.6% | 0.0% | 2.9% | 2.2% | | Level 1 | 13.1% | 16.4% | 7.4% | 13.2% | | Level 2 | 13.1% | 14.8% | 11.8% | 13.2% | | Level 3 | 8.3% | 4.8% | 17.6% | 11.3% | | Level 4 | 61.9% | 64.0% | 60.3% | 60.1% | | Total students | 168 | 189 | 68 | 425 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 83.3% | 83.6% | 89.7% | 84.6% | | Not Met | 16.7% | 16.4% | 10.3% | 15.4% | | Overall, 84.6% of students assessed are learning at level 2 or higher indicating students’ nearing success in learning objective 2 concept.  An increase in student success was observed for the 2018-19 academic year. Continue current instructional methods which included in-class lectures and practice problems for on-campus sections and Power Point lessons as well as numerous written and video examples for online sections. |
| MTH 110 Objective 3  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to use Bayes’ Theorem to solve a problem | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 5.4% | 1.6% | 2.9% | 3.3% | | Level 1 | 41.1% | 49.2% | 16.2% | 35.5% | | Level 2 | 13.7% | 19.7% | 23.5% | 19.0% | | Level 3 | 14.3% | 13.2% | 30.9% | 19.4% | | Level 4 | 25.5% | 16.3% | 26.5% | 22.8% | | Total Students | 168 | 189 | 68 | 425 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 53.5% | 49.2% | 80.9% | 61.2% | | Not Met | 46.5% | 50.8% | 19.1% | 38.8% | | Overall, 61.2% of students assessed are learning at level 2 or higher indicating students’ difficulty in learning objective 3 concept. Although students still demonstrated inability to recall necessary formulas and/or the ability to construct the required tree diagram to complete this objective, the success rate is making improvements.  Additional practice/examples will continue to be given in the classroom and videos will be implemented in the online classes to help complete the objective. |
| MTH 110 Objective 4  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to compute the mean, variance, and standard deviation of a random variable | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 3.0% | 1.6% | 5.9% | 3.5% | | Level 1 | 17.3% | 25.4% | 13.2% | 18.6% | | Level 2 | 17.3% | 20.1% | 19.1% | 18.8% | | Level 3 | 11.9% | 5.3% | 20.6% | 12.6% | | Level 4 | 50.5% | 47.6% | 41.2% | 46.5% | | Total Students | 168 | 189 | 68 | 425 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 79.7% | 73.0% | 80.9% | 77.9% | | Not Met | 20.3% | 27.0% | 19.1% | 22.1% | | 77.9% of students assessed are learning at level 2 or higher with a steady increase in the overall success percentage through the years indicating continued success in objective 4 concept instruction. Continue current instructional methods which included in-class lectures and practice problems for on-campus sections and Power Point lessons as well as numerous written and video examples for online sections. |
| **Plan submission date: September 13, 2019** | | | **Submitted by: Sam White** | |

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| **Instructional Program Outcomes & Assessment Plan – MTH 112**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate knowledge of functions and their graphs by his/her ability to  1. Solve a linear equation in one variable  2. Calculate the volume of a solid object or container  3. Calculate percentage | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| **Assessment of Objective 1**  The student will demonstrate knowledge of functions and their graphs by his/her ability to find the inverse of a given function. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 37/460  8.04% | 93/524  17.75% | 53/455  11.65% | 183/1439  12.72% | | **Level 1** | 76/460  16.52% | 81/524  15.46% | 74/455  16.26% | 231/1439  16.05% | | **Level 2** | 44/460  9.56% | 62/524  11.83% | 42/455  9.23% | 148/1439  10.28% | | **Level 3** | 69/460  15.00% | 71/524  13.55% | 56/455  12.31% | 196/1439  13.62% | | **Level 4** | 234/460  50.87% | 217/524  41.41% | 230/455  50.55% | 681/1439  47.32% | | **Level 2 or Higher**  **%** | **347/460**  **75.4%** | **350/524**  **66.79%** | **328/455**  **72.09%** | **1025/1439**  **71.23%** | | The Level 2, or higher, success rate for the SLO 3-year period 2016-2019, exceeds the objective of 70%. The Mathematics Division will continue to measure this objective and obtain the improvement which is seen from year 2 to year 3 of the SLO period. |
| **Assessment of Objective 2**  The student will demonstrate knowledge of functions and their graphs by his/her ability to use properties of exponents/logarithms to solve given problems. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 39/435  8.97% | 70/524  13.36% | 47/455  10.33% | 156/1414  11.03% | | **Level 1** | 84/435  19.31% | 137/524  26.15% | 86/455  18.90% | 307/1414  21.71% | | **Level 2** | 90/435  20.69% | 106/524  20.23% | 84/455  18.46% | 280/1414  19.80% | | **Level 3** | 29/435  6.67% | 38/524  7.25 | 42/455  9.23% | 109/1414  7.71% | | **Level 4** | 193/435  44.37% | 173/524  33.02% | 197/455  43.30% | 563/1414  39.82% | | **Level 2 or Higher**  **%** | **312/435**  **71.72%** | **317/524**  **60.50%** | **323/455**  **70.99%** | **952/1414**  **67.33%** | | The Level 2, or higher, success rate for 2016-2019, missed the objective of 70% by 2.67%. The Mathematics Division should continue to measure this objective to obtain the improvement which is seen from year 2 to year 3 of the SLO period. |
| **Assessment of Objective 3**  The student will demonstrate knowledge of functions and their graphs by his/her ability to find the zeros of a polynomial function. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 38/460  8.26% | 84/524  16.03% | 76/455  16.70% | 198/1439  13.76% | | **Level 1** | 86/460  18.70% | 255/524  48.66% | 66/455  14.51% | 407/1439  28.28% | | **Level 2** | 77/460  16.74% | 106/524  20.23% | 71/455  15.60% | 254/1439  17.65% | | **Level 3** | 108/460  23.48% | 115/524  21.95% | 93/455  20.44% | 316/1439  21.96% | | **Level 4** | 151/460  32.83% | 123/524  23.47% | 149/455  32.75% | 423/1439  29.40% | | **Level 2 or Higher**  **%** | **336/460**  **73.04%** | **344/524**  **65.65%** | **313/455**  **68.79%** | **993/1439**  **69.01%** | | The Level 2, or higher, success rate for 2016-2019, missed the objective of 70% by 0.99%. The Mathematics Division should continue to measure this objective but consider fine-tuning the problem so that it better measures the stated objective. |
| **Assessment of Objective 4**  The student will demonstrate knowledge of functions and their graphs by his/her ability to graph transformations of basic functions. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 32/460  6.96% | 28/524  5.34% | 23/456  5.04% | 83/1440  5.76% | | **Level 1** | 34/460  7.39% | 50/524  9.54% | 41/456  8.99% | 125/1440  8.68% | | **Level 2** | 76/460  13.48% | 111/524  21.18% | 58/456  12.72% | 231/1440  16.04% | | **Level 3** | 65/460  14.13% | 101/524  19.27% | 85/456  18.64% | 251/1440  17.43% | | **Level 4** | 256/460  55.65% | 234/524  44.66% | 249/456  54.61% | 739/1440  51.32% | | **Level 2 or Higher**  **%** | **397/460**  **86.30%** | **446/524**  **85.11%** | **392/456**  **85.96%** | **1221/1440**  **84.79%** | | This objective has consistently had the highest success rate, exceeding our 70% objective by 14.79%, for the 3-year period. The Mathematics Division may want to consider replacing this objective for the next 3- year SLO period, Fall 2019- Spring 2022. |
| Plan Submission Date: 9/26/2019 | | | Submitted by: Peggy Thrasher & Yu-ing Hargett | |
| Reflections\Implications: The intended success rates, in Math 112, were met on 2 of the 4 objectives. Objective 2 missed the target of 70% at Level 2 or higher, by 2.67%. Objective 3 missed the target of 70% at Level 2, or higher, by 0.99%. In all 4 objectives, the middle year success rate decreased compared to the first year, and it increased again in year 3. Twice in this 3-year period the course outline in the prerequisite course, Math 100, changed. What impact these changes had on the fluctuating success rates cannot be measured. The success, or near success, in all 4 objectives, despite of these fluctuations, is in a positive direction. The ability to determine useful recommendations for targeting future improvements in success rate in Math 112, should be positively impacted by the stability in the course outline of the prerequisite course, Math 100, over the next 3-year SLO period. | | | | |

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| **Instructional Program Outcomes & Assessment Plan – MTH 113**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to  1. Graph a given trigonometric function  2. Find the values for trigonometric functions using a right triangle.  3. Perform algebraic operations on vectors.  4. Convert and use the trigonometric form of a complex number.  5. Convert an equation from polar form to rectangular form. |

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| **Instructional Program Outcomes & Assessment Plan – MTH 113**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to  1. Graph a given trigonometric function  2. Find the values for trigonometric functions using a right triangle.  3. Perform algebraic operations on vectors.  4. Convert and use the trigonometric form of a complex number.  5. Convert an equation from polar form to rectangular form. | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 113 Objective 1  Graph a given trigonometric function | Rubric based assessment of related common test problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 2.5% | 9.4% | 0.0% | 4.0% | | Level 1 | 11.6% | 25.5% | 0.0% | 12.4% | | Level 2 | 16.7% | 17.9% | 17.4% | 17.3% | | Level 3 | 21.7% | 13.2% | 30.4% | 21.7% | | Level 4 | 47.5% | 34.0% | 52.2% | 44.6% |   Total # 120 106 23 249  Level 2 and Above  Met 85.9% 65.1 % 100% 83.6%  Not  Met 14.1% 34.9% 0.0% 16.4% | Even though percentages reflect a fewer number of students from first year to third year, all students attempted to solve the problem (Level 0) with some level of understanding (Level 1). From year one to year three, Level 2 had a slight increase; however, Levels 3 and 4 were significantly higher. At the end of the third year, 83.6% of students scored at Level 2 or above. This surpasses the benchmark for success. It is suggested for monitoring to continue for this objective. |
| MTH 113 Objective 2  Find the values for trigonometric functions using a right triangle. | Rubric based assessment of related common test problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 3.3% | 1.9% | 0.0% | 1.7% | | Level 1 | 1.7% | 6.6% | 8.7% | 5.7% | | Level 2 | 10.8% | 17.0% | 8.7% | 12.2% | | Level 3 | 10.0% | 19.8% | 8.7% | 12.8% | | Level 4 | 74.2% | 54.7% | 73.9% | 67.6% |   Total # 120 106 23 249  Level 2 and Above  Met 95.0% 91.5 % 91.3% 92.6%  Not  Met 5.0% 8.5% 8.7% 7.4% | Each year the actual success exceeded the criteria for success. At the end of year three, 92.6% of students scored at Level 2 or above. It is suggested for monitoring to continue for this objective. |
| MTH 113 Objective 3  Perform algebraic operations on vectors. | Rubric based assessment of related common test problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 2.5% | 2.8% | 8.7% | 4.7% | | Level 1 | 2.5% | 3.8% | 4.3% | 3.5% | | Level 2 | 4.2% | 14.2% | 13.0% | 10.5% | | Level 3 | 8.3% | 11.3% | 8.7% | 9.4% | | Level 4 | 82.5% | 67.9% | 65.3% | 71.9% |   Total# 120 106 23 249  Level 2 and Above  Met 95.0% 93.4% 87.0% 91.8%  Not  Met 5.0% 6.6% 13.0% 8.2% | Each year the actual success exceeded the criteria for success. At the end of year three, 91.8% of students scored at Level 2 or above. It is suggested for monitoring to continue for this objective. |
| MTH 113 Objective 4  Convert and use the trigonometric form of a complex number. | Rubric based assessment of related common test problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 24.2% | 32.1% | 39.1% | 31.8% | | Level 1 | 6.7% | 31.1% | 17.4% | 18.4% | | Level 2 | 8.3% | 8.5% | 8.7% | 8.5% | | Level 3 | 18.3% | 9.4% | 0.0% | 9.2% | | Level 4 | 42.5% | 18.9% | 34.8% | 32.1% |   Total# 120 106 23 249  Level 2 and Above  Met 69.1% 36.8% 43.5% 49.8%  Not  Met 30.9% 63.2% 56.5% 50.2% | In no year did the actual success exceed the criteria for success. A three-year total reflected 31.8% of students not even attempting a solution (Level 0). The percentages for success significantly deceased within the three-year period. This is a multi-skill problem combining several concepts. This is generally taught near the end of the course and is a new topic for many students. The suggestion is a handout of many examples or a list of web links with examples to view. |
| MTH 113 Objective 5  Convert an equation from polar form to rectangular form. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 20.0% | 12.3% | 13.0% | 15.1% | | Level 1 | 15.0% | 23.6% | 13.0% | 17.2% | | Level 2 | 11.7% | 4.7% | 4.4% | 6.9% | | Level 3 | 9.2% | 8.5% | 0.0% | 5.9% | | Level 4 | 44.1% | 50.9% | 69.6% | 54.9% |   Total# 120 106 23 249  Level 2 and Above  Met 65.0% 64.1% 74.0% 67.7%  Not  Met 35.0% 35.9% 26.0% 32.3% | In only one year (2018-2019) did the actual success exceed the criteria for success. A three-year total reflected 32.3% of students at Levels 0 and 1. The percentages reflecting success increased from year one to year three, but the overall outcome did not reach 70%. The suggestion is a handout of many examples or a list of web links with examples to view. |
| **Plan submission date: September 13, 2019** | | | **Submitted by: Louise Fall** | |
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| **Instructional Program Outcomes & Assessment Plan – MTH 116**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate knowledge of functions and their graphs by his/her ability to  1. Solve a linear equation in one variable  2. Calculate the volume of a solid object or container  3. Calculate percentage |

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| **Intended Outcomes** | **Means of Assessment** | | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| **Assessment of Objective 1**  Solve a linear equation in one variable | Rubric based assessment of related common final exam problems | | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 8/87  9.19% | 1/59  1.69% | 11/108  10.19% | 20/254  7.88% | | **Level 1** | 0/87  0.00% | 8/59  13.56% | 0/108  0.00% | 8/254  3.15% | | **Level 2** | 22/87  25.29% | 24/59  40.68% | 14/108  12.96% | 60/254  23.62% | | **Level 3** | 0/87  0.00% | 0/59  0.00% | 0/108  0.00% | 0/254  0.00% | | **Level 4** | 57/87  65.52% | 26/59  44.07% | 83/108  76.85% | 166/254  65.35% | | **Level 2 or Higher**  **%** | **79/87**  **90.8%** | **50/59**  **84.75%** | **97/108**  **89.81%** | **226/254**  **88.98%** | | The Level 2 or higher success rate from 2016-2019 is 88.98%. This is extraordinarily high and is well above the goal of 70%. However, it is important to note that 26.77% (68/254) of students were not able to produce a correct answer. This is down from the last three-year report when the percentage was almost 37%. Additional time and emphasis should be placed on these problems to minimize careless errors. To decrease the percentage of students who didn’t attempt the problem, emphasis should be added in the initial instructions that it is imperative to attempt every problem on the exam and instructors should verbally express the importance of attempting every problem before the exam begins. |
| **Assessment of Objective 2**  Calculate the volume of a solid object or container | Rubric based assessment of related common final exam problems | | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 11/87  12.64% | 2/59  3.39% | 14/108  12.96% | 27/254  10.63% | | **Level 1** | 0/87  0.00% | 3/59  5.08% | 0/108  0.00% | 3/254  1.18% | | **Level 2** | 22/87  25.29% | 22/59  37.29% | 29/108  26.85% | 73/254  28.74% | | **Level 3** | 0/87  0.00% | 0/59  0.00 | 0/108  0.00% | 0/254  0.00% | | **Level 4** | 54/87  62.07% | 31/59  52.54% | 65/108  60.19% | 150/254  59.06% | | **Level 2 or Higher**  **%** | **76/87**  **87.36%** | **53/59**  **89.83%** | **94/108**  **87.04%** | **223/254**  **87.80%** | | Objective 2 requires students to calculate the volume of a solid in cubic inches and then convert the volume to a capacity (gallons). Again, overall success for this problem is high at 87.8% with 223/254 students scoring at level 2 or higher. However, again we see that the number of students who produce a correct solution (Level 4) is low at 59.06% (150/254). However, Level 4 performance for the current 3-year period is drastically higher than the last 3-year period. Level 4 performance from 2013-2016 was only at 30.7%. While reviewing the text, only 9 problems address conversion from volume to capacity and NONE of these problems specifically address converting volume of a right circular cylinder to gallons. Additional focus should be placed on providing students additional problems for this skill. |
| **Assessment of Objective 3**  Calculate percentage. | Rubric based assessment of related common final exam problems | | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | **2016- 2017** | **2017- 2018** | **2018-2019** | **Total**  **2016-2019** | | **Level 0** | 8/87  9.20% | 2/59  3.39% | 14/108  12.96% | 24/254  9.45% | | **Level 1** | 0/87  0.00% | 4/59  6.78% | 0/108  0.00% | 4/254  1.57% | | **Level 2** | 27/87  31.03% | 20/59  33.90% | 33/108  30.56% | 80/254  31.50% | | **Level 3** | 0/87  0.00% | 0/59  0.00% | 0/108  0.00% | 0/254  0.00% | | **Level 4** | 52/87  59.77% | 33/59  55.93% | 61/108  56.48% | 146/254  57.48% | | **Level 2 or Higher**  **%** | **79/87**  **90.8%** | **53/59**  **89.83%** | **94/108**  **87.04%** | **226/254**  **88.98%** | | For Objective 3, the percentage of students who scored at Level 2 or higher was 88.98% (226/254). Again, the goal of 70% has been exceeded drastically. This number is up from the last 3-year report when only 73.3% of students performed at or above Level 2. Although performance is up overall, Level 4 performance is still quite low. This is concerning because this Objective focuses on real-world application of percentages and requires students to calculate a total sales goal given a percentage of the goal. Students typically struggle with identifying the three parts of a percent problem, the base, the percent, and the amount. Going forward, more time will be spent assisting students with different ways to identify the base, the percent, and the amount. Again, it is noted that very few word problems closely related to the Objective 3 problem are available for homework in the text. Additional problems of this kind will be given to students in addition to the problems from the text. |
| Plan Submission Date: 9/25/2019 | | Submitted by: J. Holley | |  | |
| Reflections\Implications: The intended success rates were greatly exceeded for each of the learning outcomes. Despite the success over the last three years, additional efforts should be taken to increase Level 4 performance for each of the SLOs. The major challenge with this lies with the online instructors as most students enrolled in MTH 116, enroll in the online sections. Due to the lack of practice problems available in the online system, consideration may be taken to review the current text book\online platform and change to a different provider going forward. | | | | | |

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| **Instructional Program Outcomes & Assessment Plan – MTH 120**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to  1. Find an equation of the tangent line to the graph of a given function at a specified point  2. Solve a related rates problem  3. Find the absolute extrema of a given function  4. Solve an initial value problem  5. Determine the Consumers’ and Producers’ Surplus | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 120 Objective 1  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to find an equation of the tangent line to the graph of a given function at a specified point | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 5.0% | 0.0% | 2.0% | 2.3% | | Level 1 | 21.0% | 43.0% | 36.0% | 33.3% | | Level 2 | 11.0% | 22.0% | 36.0% | 23.0% | | Level 3 | 5.0% | 11.0% | 19.0% | 11.7% | | Level 4 | 58.0% | 24.0% | 7.0% | 29.7% | | Total Students | 57 | 37 | 58 | 152 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 74.0% | 57.0% | 62.0% | 64.4% | | Not Met | 26.0% | 43.0% | 38.0% | 35.6% | | In only one year (2016-2017) did the actual success exceed the criteria for success. A three-year total reflected 64.4% of students at Level 2 or above. It is suggested for monitoring of this objective to continue. |
| MTH 120 Objective 2  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to solve a related rates problem | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 5.0% | 0.0% | 3.4% | 2.8% | | Level 1 | 7.0% | 73.0% | 17.3% | 32.4% | | Level 2 | 37.0% | 22.0% | 72.4% | 43.8% | | Level 3 | 12.0% | 0.0% | 1.7% | 4.6% | | Level 4 | 39.0% | 5.0% | 5.2% | 16.4% | | Total Students | 57 | 37 | 58 | 152 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 88.0% | 27.0% | 79.3% | 64.8% | | Not Met | 12.0% | 73.0% | 20.7% | 35.2% | | Percentages for 2016-2017 and 2018-2019 indicated outcomes considerably above the threshold of 70%. Unfortunately, 2017-2018 resulted in a drop. It is suggested for monitoring of this subject to continue. |
| MTH 120 Objective 3  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to find the absolute extrema of a given function | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 7.0% | 0.0% | 1.7% | 2.9% | | Level 1 | 14.0% | 35.2% | 29.3% | 26.2% | | Level 2 | 21.1% | 40.5% | 58.7% | 40.1% | | Level 3 | 7.0% | 13.5% | 6.9% | 9.1% | | Level 4 | 50.9% | 10.8% | 3.4% | 21.7% | | Total Students | 57 | 37 | 58 | 152 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 79.0% | 64.8% | 69.0% | 70.9% | | Not Met | 21.0% | 35.2% | 31.0% | 29.1% | | In only one year (2016-2017) did the actual success exceed the criteria for success. A three-year total reflected 70.9% of students at Level 2 or above. It is suggested for monitoring of this objective to continue. |
| MTH 120 Objective 4  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to solve an initial value problem | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 7.0% | 0.0% | 0.0% | 2.3% | | Level 1 | 14.0% | 37.8% | 29.3% | 27.0% | | Level 2 | 8.8% | 21.6% | 51.7% | 27.4% | | Level 3 | 24.6% | 2.8% | 5.2% | 10.9% | | Level 4 | 45.6% | 37.8% | 13.8% | 32.4% | | Total Students | 57 | 37 | 58 | 152 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 79.0% | 62.2% | 70.7% | 70.7% | | Not Met | 21.0% | 37.8% | 29.3% | 29.3% | | 70.7% of students at the end of three years exceeded the criteria for success. This is a slim margin of success. It is suggested for monitoring of this subject to continue. |
| MTH 120 Objective 5  The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to  determine the Consumers’ and Producers’ Surplus | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 8.8% | 0.0% | 5.2% | 4.7% | | Level 1 | 36.8% | 70.3% | 37.9% | 48.3% | | Level 2 | 1.8% | 13.5% | 36.2% | 17.2% | | Level 3 | 7.0% | 2.7% | 15.5% | 8.4% | | Level 4 | 45.6% | 13.5% | 5.2% | 21.4% | | Total Students | 57 | 37 | 58 | 152 |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Level 2 and Above | | | |  | | Met | 54.4% | 29.7% | 56.9% | 47.0% | | Not Met | 45.6% | 70.3% | 43.1% | 53.0% | | Level 1 consistently had high percentages indicating attempts at working the problem but with little understanding. Only 47.0% of students were at Level 2 or above. It is suggested for monitoring of this subject to continue. |
| **Plan submission date: September 13, 2019** | | | **Submitted by: Louise Fall & Sam White** | |

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| **Program or Department Mission:**  The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics. | | | | |
| **Instructional Program Outcomes & Assessment Plan – MTH 125s**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors. Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students’ field of study. Student mastery of the specific course objectives that follow will be evaluated  by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.  The student will demonstrate knowledge of the methods presented in this course by his/her ability to | | | | |
| 1. Solve a limit problem 2. Compute a derivative 3. Compute a definite integral | | | | | | |
| **Intended Outcomes** | | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** | |
| MTH 125s Objective 1  The student will demonstrate knowledge of the methods presented in this course by his/her ability to solve a limit problem. | | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 0.5% | 1.6% | 0% | **0.7%** | | Level  1 | 17.0% | 12.9% | 5% | **11.6%** | | Level  2 | 6.5% | 17.8% | 22% | **15.4%** | | Level  3 | 5.6% | 16.1% | 25% | **15.7%** | | Level  4 | 70.4% | 51.6% | 48% | **56.6%** | | More than 70% of students met the criteria for success for objective 1. | |

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| MTH 125s Objective 2  The student will demonstrate knowledge of the methods presented in this course by his/her ability to compute a derivative. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 0% | 1.7% | 2.4% | **1.4%** | | Level  1 | 4.6% | 0% | 3.9% | **2.8%** | | Level  2 | 7.4% | 11.3% | 7.1% | **8.6%** | | Level  3 | 1.4% | 17.7% | 15.7% | **11.6%** | | Level  4 | 86.6% | 69.3% | 70.9% | **75.6%** | | More than 70% of students met the criteria for success for objective 2. |
| MTH 125s Objective 3 |  |  | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 0.4% | 3.2% | 0% | **1.2%** | | Level  1 | 4.5% | 11.3% | 4.7% | **6.8%** | | Level  2 | 7.9% | 14.5% | 12.7% | **11.7%** | | Level  3 | 2.7% | 24.2% | 29.9% | **19.0%** | | Level  4 | 84.5% | 46.8% | 52.7% | **61.3%** | | More than 70% of students met the criteria for success for objective 3.  Reflections/Implications  The intended success rate was met for each of the learning outcomes. which may suggest a need to re-evaluate the level of difficulty of the questions and compare to performance with similar questions for the in-class test. Increased demand in the on-line class version also suggests a closer look of grading procedures. |
| The student will demonstrate knowledge of the methods presented in this course by his/her ability to compute an indefinite integral. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher |
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Reflections/Implications

The intended success rate was met for each of the learning outcomes. which may suggest a need to re-evaluate the level of difficulty of the questions and compare to performance with similar questions for the in-class test. Increased demand in the on-line class version also suggests a closer look of grading procedures.

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| **Instructional Program Outcomes & Assessment Plan – MTH 126s**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors. Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students’ field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.  The student will demonstrate knowledge of the methods presented in this course by his/her ability to |

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| 1. Find the length of an arc of a plane function, using a definite integral. 2. Use the method of partial fractions to compute an indefinite integral. 3. Write the Taylor series for a given function. |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of**  **Assessment Evidence** | | | | | | | **Use of Results** |
| MTH 126s Objective 1  The student will demonstrate knowledge of the methods presented in this course by his/her ability to find the length of an arc of a plane function, using a definite integral. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher |  |  | **Academic Year** | | | |  | More than 70% of students met the criteria for success for objective 1  An increase of almost 20% points from 61% of the 2013-2016 cycle to 80.7% for the current cycle |
|  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total**  **2016-**  **2019** |
| Level  0 | 3.5% | 5.2% | 9.0% | **5.9%** |
| Level  1 | 4.8% | 10.3% | 25.0% | **13.4%** |
| Level  2 | 40.5% | 24.8% | 25.0% | **30.2%** |
| Level  3 | 27.4% | 27.8% | 20.5% | **25.1%** |
| Level  4 | 23.8% | 31.9% | 20.5% | **25.4%** |
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| MTH 126s Objective 2 |  |  | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 2.3% | 7.2% | 11.2% | **6.9%** | | Level  1 | 10.6% | 2.2% | 27.3% | **13.4%** | | Level  2 | 40.3% | 35.0% | 20.5% | **31.9%** | | Level  3 | 21.3% | 17.5% | 20.5% | **19.8%** | | Level  4 | 25.5% | 38.1% | 20.5% | **28.0%** | | | | | | | |  | |
|  | Rubric based | 70% of students | More than 70% of | |
| The student will demonstrate knowledge of the methods presented in this course by his/her ability to use the method of partial fractions to compute an indefinite integral. | assessment of related  common final exam problems | learning at a  rubric level of 2 or higher | students met the  criteria for success for objective 2. No need for change at this time. | |
|  |  |  |  |  | **Academic Year** | | | |  |  |
| MTH 126s Objective 3  The student will demonstrate knowledge of the methods presented in this course by his/her ability to write the Taylor series for a given function. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | Fewer than 70% of students met the criteria for success for objective 3.  Additional emphasis on this topic may be required.  Reflections/Implications  It is suggested that a unified set of formulas is created to be provided during testing in order to measure possible heteroscedasticity creeping into the assessment rubric.c |
| Level  0 | 11.9% | 7.3% | 15.9% | **11.7%** |
| Level  1 | 16.7% | 14.4% | 29.6% | **20.3%** |
| Level  2 | 40.5% | 20.6% | 34.1% | **31.7%** |
| Level  3 | 17.9% | 27.8% | 6.8% | **17.5%** |
| Level  4 | 13.0% | 29.9% | 13.6% | **18.8%** |
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| MTH 126s Objective 2 |  |  | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 2.3% | 7.2% | 11.2% | **6.9%** | | Level  1 | 10.6% | 2.2% | 27.3% | **13.4%** | | Level  2 | 40.3% | 35.0% | 20.5% | **31.9%** | | Level  3 | 21.3% | 17.5% | 20.5% | **19.8%** | | Level  4 | 25.5% | 38.1% | 20.5% | **28.0%** | | | | | | | |  | |
|  | Rubric based | 70% of students | More than 70% of | |
| The student will demonstrate knowledge of the methods presented in this course by his/her ability to use the method of partial fractions to compute an indefinite integral. | assessment of related  common final exam problems | learning at a  rubric level of 2 or higher | students met the  criteria for success for objective 2. No need for change at this time. | |
|  |  |  |  |  | **Academic Year** | | | |  |  |
| MTH 126s Objective 3  The student will demonstrate knowledge of the methods presented in this course by his/her ability to write the Taylor series for a given function. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | Fewer than 70% of students met the criteria for success for objective 3.  Additional emphasis on this topic may be required.  Reflections/Implications  It is suggested that a unified set of formulas is created to be provided during testing in order to measure possible heteroscedasticity creeping into the assessment rubric.c |
| Level  0 | 11.9% | 7.3% | 15.9% | **11.7%** |
| Level  1 | 16.7% | 14.4% | 29.6% | **20.3%** |
| Level  2 | 40.5% | 20.6% | 34.1% | **31.7%** |
| Level  3 | 17.9% | 27.8% | 6.8% | **17.5%** |
| Level  4 | 13.0% | 29.9% | 13.6% | **18.8%** |
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Reflections/Implications

It is suggested that a unified set of formulas is created to be provided during testing in order to measure possible heteroscedasticity creeping into the assessment rubric.

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| **Instructional Program Outcomes & Assessment Plan – MTH 227**  **Mathematics Course Level Outcomes Assessment Rubric\***  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students’ field of study. Student mastery of the specific course objectives that follow will be evaluated  by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy. The student will demonstrate knowledge of the methods presented in this course by his/her ability to   1. Find the equation of a plane. 2. Compute the directional derivative of a function. 3. Set up and evaluate a double integral. | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| MTH 227 Objective 1 | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 7% | 2% | 0% | 3% | | Level 1 | 3% | 2% | 8% | 5% | | Level 2 | 13% | 17% | 26% | 19% | | Level 3 | 29% | 29% | 30% | 29% | | Level 4 | 48% | 50% | 36% | 44% | | Approximately 92% of students met the criteria for success for objective 1. This is the same as the 92% rate of success on the previous 3-year summary. Students seem to be doing well on most the fundamental techniques but a review of vector cross products may be beneficial. |
| MTH 227 Objective 2 | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 7% | 2% | 2% | 3% | | Level 1 | 0% | 0% | 11% | 4% | | Level 2 | 16% | 17% | 19% | 18% | | Level 3 | 35% | 24% | 28% | 28% | | Level 4 | 42% | 57% | 40% | 47% | | Approximately 93% of students met the criteria for success for objective 2. This is down from the 94% rate of success on the previous 3-year summary. Students still generally seem to be doing well on most the fundamental techniques but a review partial differentiation and dot products of vectors may still help. |
| MTH 227 Objective 3 | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016- 2017 | 2017- 2018 | 2018-2019 | Total  2016-2019 | | Level 0 | 3% | 2% | 4% | 3% | | Level 1 | 7% | 5% | 8% | 7% | | Level 2 | 7% | 19% | 26% | 18% | | Level 3 | 32% | 26% | 32% | 30% | | Level 4 | 51% | 48% | 30% | 42% | | Approximately 90% of students met the criteria for success for objective 3. This down from 91% rate of success on the previous 3-year summary. Students seem to be doing well on most the fundamental techniques but a review of basic integration formulas may be needed. |









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| **Instructional Program Outcomes & Assessment Plan – MTH 265**  **Mathematics Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors. Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students’ field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. Students will be graded on the quality of their technique, notation, and accuracy. The student will demonstrate knowledge of the methods presented in this course by his/her ability to   1. Calculate variance and standard deviation for a set of sample data 2. Estimate an interval for the true mean from a set of sample data 3. Set up and conduct a statistical test for the mean | | | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | | **Use of Results** |
| MTH 265 Objective 1 Calculating variance and standard deviation for a set of sample data | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 3.5% | 0% | 0% | **1.2%** | | Level  1 | 24.0% | 0% | 0% | **9.8%** | | Level  2 | 0% | 34.7% | 0% | **0%** | | Level  3 | 0% | 0% | 0% | **0%** | | Level  4 | 73.5% | 62.5% | 100% | **89.0%** | |  |  | More than 70% of students met the criteria for success for objective 1 |

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| MTH 265 Objective 2 | | | | Rubric based | | | 70% of students |  |  |  | More than 70% of students met the criteria for success for objective 2 |
|  | | | | assessment of related | | | learning at a rubric |  |  |  |
|  | | **Academic Year** | | | | |
|  | | 2016-  2017 | 2017-  2018 | 2018-  2019 | | **Total 2016-**  **2019** |
| Level  0 | | 5.5% | 5.3% | 0% | | **3.6%** |
| Level  1 | | 27.5% | 10.5% | 0% | | **12.7%** |
| Level  2 | | 0% | 0% | 0% | | **0%** |
| Level  3 | | 0% | 0% | 0% | | **0%** |
| Level  4 | | 67.0% | 84.2% | 100.0% | | **83.7%** |
| Estimating an interval for the true mean from a set of sample data | | | | common final exam  problems | | | level of 2 or higher |  |  |  |  |
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| MTH 265 Objective 3 | Rubric based | 70% of students |  |  |  | More than 70% of students met the criteria for success for objective 3  Reflections/Implications  High success ratio may suggest a reconsideration of the grading rubric between the physical class and the online versions. The statistical anomalies generated by the variability in the collected data are closely related to grading rubrics. A statistically significant portion of data was not reported suggesting a more diligent approach to be implemented in the data collection for the next 3-year and each 1-year cycles. |
|  | assessment of related | learning at a rubric | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2016-  2017 | 2017-  2018 | 2018-  2019 | **Total 2016-**  **2019** | | Level  0 | 5.2% | 10.5% | 0% | **5.3%** | | Level  1 | 19.3% | 10.5% | 0% | **9.9%** | | Level  2 | 0% | 0% | 0% | **0%** | | Level  3 | 0% | 0% | 0% | **0%** | | Level  4 | 75.5% | 79.0% | 100% | **84.8%** | |  |  |
| Set up and conduct a statistical test for the mean | common final exam  problems | level of 2 or higher |  |  |  |

Reflections/Implications

High success ratio may suggest a reconsideration of the grading rubric between the physical class and the online versions. The statistical anomalies generated by the variability in the collected data are closely related to grading rubrics. A statistically significant portion of data was not reported suggesting a more diligent approach to be implemented in the data collection for the next 3-year and each 1-year cycles.

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| **Course Student Learning Outcomes & Assessment Plan PHY 201 General Physics with Trigonometry**  General Education Outcome  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  Department Level Student Learning Outcomes   1. Students will acquire content knowledge of the physical sciences and mathematics. 2. Students will develop problem solving and critical thinking skills. 3. Students will be prepared to use mathematics in other disciplines.   Course Objective Assessed  The student will demonstrate fundamental skills of physics and mathematics to solve problems by his/her ability to   1. Understand Newton’s laws and attendant concepts will apply these in appropriate situations. 2. Understand energy and momentum and be able to apply these concepts to describing the behavior of system of particles. 3. Understand and be able to apply principles relating to the macroscopic properties of matter (State and apply Archimedes’ Principle and Bernoulli’s relation in problem situations.   The rubric used follows the assessment results. |

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| **Instructional Program Outcomes & Assessment Plan** | | | | |
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| PHY 201 Objective 1  1. Understand Newton’s laws and attendant concepts will apply these in appropriate situations. | Rubric based assessment of related final exam problems. | |  | | --- | |  | | | |   At least 70% of students will produce solutions at  Rubric level 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 16-17 | 17-18 | 18-19 | Total | | Level 3 | 69.5% | 65% | 66.7% | 68.2% | | Level 2 | 0.0% | 0% | 6.7% | 0.57% | | Level 1 | 9.3% | 17.%5 | 13.3% | 11.6% | | Level 0 | 21% | 17.5% | 13.3% | 19.6% | | Level 2 or higher | 69.5%  20 students | 65%  22 student | 73.4%  3 students | 68.8% | | 68.8% of solutions related to PHY 201 objective 1 were assessed at rubric level 2 or higher which is close to the criteria for success.  This is an indicator of success in achieving department level student learning outcomes.    31.2% at level 0 and 1 combined is very high. Fundamental ideas of the 2nd law of Newton must be emphasized. Students must be given more multi-steps problems dealing with Newton’s Laws of motion using the results of Physics Education Research. |
| 2. Understand energy and momentum and be able to apply these concepts to describing the behavior of system of particles. | Rubric based assessment of related final exam problems. | At least 70% of students will produce solutions at  Rubric level 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 16-17 | 17-18 | 18-19 | Total | | Level 3 | 42% | 72.9% | 88.8% | 51.5% | | Level 2 | 18% | 2.7% | 11.1% | 14.1% | | Level 1 | 14% | 29.6% | 0.0% | 14.7% | | Level 0 | 26.5% | 2.7% | 0.0% | 19.6% | | Level 2 or higher | 60% | 75.7% | 100% | 65.6% | | 65.6% of solutions related to PHY 201 objective 2 were assessed at rubric level 2 or higher.  Instructor comments indicate that there is a need to include more challenging questions such as more emphasis on multi-skills as well as spring potential energy problems. |
| 3. Understand and be able to apply principles relating to the macroscopic properties of matter (State and apply Archimedes’ Principle and Bernoulli’s relation in problem situations. | Rubric based assessment of related final exam problems. | At least 70% of students will produce solutions at  Rubric level 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 16-17 | 17-18 | 18-19 | Total | | Level 3 | 42.5% | 40.7% | 58.3% | 43.0% | | Level 2 | 8.7% | 13.5% | 8.3% | 10.6% | | Level 1 | 7.5% | 28.8% | 16.6% | 16.6% | | Level 0 | 41% | 16.9% | 16.6% | 29.8% | | Level 2 or higher | 51.2% | 54.2% | 66.6% | 53.6% | | 53.6% of solutions related to PHY 201 objective 3 were assessed at rubric level 2 or higher which is not close to the expected criteria for success.  Must be able to cover the concepts of Bernoulli’s principle. Again, high percentages at combination of level 0 and 1 must be improved.  Below the expectations of the results for this course also reflect poor mathematical preparations of the students. Instructor recommendations are:   1. Pre-requisites requirements enforced. 2. Mathematical requirements be discussed in the beginning of the term. |
| **Plan submission date: 9/09/2019** | | | **Submitted by: Ali Yazdi** | |

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| **Course Student Learning Outcomes & Assessment Plan PHY 202 General Physics with Trigonometry**  General Education Outcome  1. Provide freshman and sophomore-level courses in Chemistry, Mathematics, Physics, Physical Sciences, and Astronomy, with emphasis on critical thinking and analytical ability, that are transferable to public institutions of higher learning.  2. Offer an appropriate developmental mathematics program accommodating various skill levels.  3. Develop and provide courses relevant to the career and professional degree programs of the college.  Department Level Student Learning Outcomes   1. Students will acquire content knowledge of the physical sciences and mathematics. 2. Students will develop problem solving and critical thinking skills. 3. Students will be prepared to use mathematics in other disciplines.   Course Objective Assessed  The student will demonstrate fundamental skills of physics and mathematics to solve problems by his/her ability to   1. Understanding of waves and oscillations. 2. Ability to apply Kirchhoff’s Rules. 3. Understand the concepts of Electric and Magnetic fields. 4. Understand the basic principles of reflection and refraction in Geometrical Optics.   The rubric used follows the assessment results. |

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|  | 3 points | 2 points | 1 points | 0 points |
| **Physics approach** | The physics approach is appropriate and complete | The physics approach contains minor omissions or errors | Some concepts and principles of the physics approach are missing/or inappropriate | Most physics approach is missing and/or inappropriate |
| **Specific Application of physics** | The specific application of physics is appropriate and complete | The specific application of physics contains minor omissions or errors | Parts of the specific application of physics are missing and/or contain errors | Most of the specific application of physics is missing and/or contains errors |
| **Mathematical procedure** | The mathematical procedures are appropriate and complete | Appropriate mathematical procedures are used with minor omissions or errors | Parts of the mathematical procedures are missing and/or contains errors | Most of the mathematical procedures are missing and/or contain errors |
| **Logical progress** | The entire solution is clear, focused and logically connected | The solution is clear and focused with minor inconsistencies | Parts of the solution are unclear, unfocused, and/or inconsistent | Most of the solution parts are unclear, unfocused, and/or inconsistent |

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| **Instructional Program Outcomes & Assessment Plan** | | | | | | |
| **Intended Outcomes** | | **Means of Assessment** | **Criteria for Success** | | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| Summary of Fall 2017 & Spring 2018 PHY 201 Objectives 1-3 | | Rubric based assessment of related final exam problems. | At least 70% of students will produce solutions at rubric level 2 or higher. | | |  | | --- | |  |   Number of Students Assessed  Fall 2017 — 0 section  Spring 2018 – 1 section /5  20 final exam questions related to the three objectives were assessed, and the number of solutions at each rubric level identified.   * 5 responses to problems related to objective 1 were assessed. * 5 responses to problems related to objective 2 were assessed. * 20 responses to problems related to objective 3 were assessed. * 9 responses to problems related to objective 4 were assessed.   Level 3 – 13(33.3%)  Level 2 - 8 (20.5%)  Level 1 – 10 (25.6%)  Level 0 – 8 (20.5%)  53.8% of solutions related to PHY202 objectives 1-3 were assessed at rubric level 2 or higher. | 53.8% of solutions related to PHY202 objectives 1-3 were assessed at rubric level 2 or higher which is not close to the success criteria set by the department. To improve the situation, there is a need to:  1. Make sure that the students taking the course have the required pre-requisite mathematics courses.  2. Ensure that the assessment focuses on the goal of students developing problem solving, conceptual understanding and critical thinking skills rather than calculational skills.  Instructor’s comments are incorporated in the individual objectives which follow below.  This small group of 5 is not statistically a desirable sample to measure the criteria for success. However, it is helpful to make the necessary changes for future offerings.  **The time that was spent on the thermodynamics concepts were excessive. In the future, less time should be devoted on these topics and more on Electricity, Magnetism and Light.** |
| PHY 202 Objective 1  1. Understanding of waves and oscillations. | | Rubric based assessment of related final exam problems. | |  | | --- | |  | | | |   At least 70% of students will produce solutions at  Rubric level 2 or higher | | Fall 2017 – Spring 2018  Number of Students Assessed  Fall 2017 — 0 section  Spring 2018 – 1 section /5  5 responses to related final exam questions were assessed, and the number of solutions at each rubric level identified.  Level 3 — 3 (60%)  Level 2 — 0 (0.0%)  Level 1— 2 (40%)  Level 0 — 0 (0%)  60% of solutions related to PHY 202 objective 1 were assessed at rubric level 2 or higher. | 60% of solutions related to PHY 202 objective 1 were assessed at rubric level 2 or higher which is close to the criteria for success.  40% at levels 0 and 1 combined, is very high.  At least 5 multi-steps problems using waves and oscillations with emphasis on the use of the results of Physics Education Research must be worked out every term. |
| 2. Ability to apply Kirchhoff’s rules. | | Rubric based assessment of related final exam problems. | At least 70% of students will produce solutions at  Rubric level 2 or higher | | Fall 2017 – Spring 2018  Number of Students Assessed  Fall 2017 — 0 section  Spring 2018 – 1 section /5  5 responses to related final exam questions were assessed, and the number of solutions at each rubric level identified.  Level 3 — 0(0%)  Level 2 — 1(20%)  Level 1— 2(40%)  Level 0 — 2 (40%)  20% of solutions related to PHY 202 objective 1 were assessed at rubric level 2 or higher. | 20% of solutions related to PHY 201 objective 2 were assessed at rubric level 2 or higher.  It is necessary to review Kirchhoff’s rules at the end of the term. Students have tendency to forget the concepts discussed earlier in the term. At least 3 problems should be worked out to demonstrate the application of these rules. |
| 3. Understanding of the concepts of Electric and Magnetic Fields. | | Rubric based assessment of related final exam problems. | At least 70% of students will produce solutions at  Rubric level 2 or higher | | Fall 2017 - Spring 2018  Number of Students Assessed  Fall 2017 — 0 section  Spring 2018 – 1 section /5  20 responses to related final exam questions were assessed, and the number of solutions at each rubric level identified.  Level 3 — 4 (20%)  Level 2 —4 (20%)  Level 1—6 (30%)  Level 0 — 6 (30%)  40% of solutions related to PHY 202 objective 1 were assessed at rubric level 2 or higher. | 40% of solutions related to PHY 201 objective 3 were assessed at rubric level 2 or higher which is nowhere near the expected criteria for success.  Must be able to cover the concepts of Electric and Magnetic field more extensively by working at least 4 problems using each concept. High percentages at levels 0 and 1 (60) must be improved. |
| 1. Student learning outcome #4   Understand the basic principles of reflection and refraction in Geometrical Optics. | Rubric based assessment of related final exam problems. | | | At least 70% of students will produce solutions at  Rubric level 2 or higher | Number of Students Assessed  Fall 2017 — 0 section  Spring 2018 – 1 section /5  9 responses to related final exam questions were assessed, and the number of solutions at each rubric level identified.  Level 3 —6 (66.7%)  Level 2 —3 33.3%)  Level 1—0 (0%)  Level 0 — 0 (0%)  100% of solutions related to PHY 202 objective 1 were assessed at rubric level 2 or higher. | Basic ideas of principles of reflection and refraction in Geometrical Optics is well understood. This is supported by the responses to the questions in the final of 100% at level 2 or higher. |
| **Plan submission date: 9/26/2018** | | | | | **Submitted by: Ali Yazdi** | |

**Comments:**

For PHY 202 in this period only one section was taught for which its assessment is included.

Also, it is worthwhile to mention that in this cycle (16-19) with the help of IT, Maintenance, Administration and Office of Grants and Public Relations, the Physics laboratory went through major renovations and updated equipment. The Physics Laboratory experiments are now in a better position to promote self-discovery and active engagement to help build the students’ self-confidence, problem solving, as well as critical thinking skills.

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| |  | | --- | | **Program or Department Mission:** |   The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics. |
| |  | | --- | | **Course Student Learning Outcomes & Assessment Plan** |   **PHY 213S General Physics with Calculus I**  General Education Outcome  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  Departmental Level Student Learning Outcomes   1. Students will acquire content knowledge of the physical sciences and mathematics. 2. Students will develop problem solving and critical thinking skills 3. Students will be prepared to use mathematics in other disciplines   Course Objective assessed  The student will demonstrate fundamental skills of physics and mathematics to solve problems by his /her ability to:   1. Solve projectile motion problems. 2. State and apply Newton’s second law 3. Calculate potential energy in the gravitational field.   The rubric used follows the assessment results. |

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| **Instructional Program Outcomes & Assessment Plan** | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| Objective 1  **Solve Projectile Motion Problems.** | Rubric based assessment of related final exam problems | At least 70% of students will produce solutions at rubric level 2 or higher. | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 2016-2017 | 2017-2018 | 2018-2019 | Total | | Level 3 | 35% | 52% | 47% | 45% | | Level 2 | 39% | 20% | 27% | 28% | | Level 1 | 13% | 24% | 13% | 16% | | Level 0 | 13% | 4% | 13% | 11% | | Approximately 73% of students met the criteria for success for objective 1. This up from 62% on the previous 3-year summary. Students seem to be doing better on this topic but a review of the quadratic formula might be helpful. |
| Objective 2  **State and apply Newton’s 2nd Law** | Rubric based assessment of related final exam problems | At least 70% of students will produce solutions at rubric level 2 or higher. | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 2016-2017 | 2017-2018 | 2018-2019 | Total | | Level 3 | 35% | 52% | 54% | 49% | | Level 2 | 39% | 24% | 29% | 30% | | Level 1 | 13% | 20% | 11% | 14% | | Level 0 | 13% | 4% | 6% | 7% | | Approximately 79% of students met the criteria for success for objective 2. This is up from 69% on the previous 3-year summary. Students seem to be doing better on this topic but more practice with free body diagrams may be beneficial as well as systems of linear equations |
| Objective 3  **Calculate Potential Energy in the Gravitational Field** | Rubric based assessment of related final exam problems | At least 70% of students will produce solutions at rubric level 2 or higher. | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Academic Year | | | | |  | 2016-2017 | 2017-2018 | 2018-2019 | Total | | Level 3 | 30% | 52% | 69% | 56% | | Level 2 | 48% | 20% | 17% | 25% | | Level 1 | 18% | 24% | 6% | 13% | | Level 0 | 4% | 4% | 8% | 6 | | Approximately 81% of students met the criteria for success for objective 3. This up from 67% on the previous 3-year summary. Students seem to be doing better on this topic but more practice in basic differentiation and integration may help. |
| **Submission date: 9/30/2019** | | | **Submitted by: Robert Wallace** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM105**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate knowledge of chemistry by his/her ability to  1. Using structural formulas, draw and name three isomers when given the molecular formula.  2. Given a Fischer structure of a monosaccharide, draw both α – and β- Haworth structures  3. Show how α-amino acids form peptide linkages. |

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| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 105 Objective 1  The student will demonstrate knowledge of chemistry by his/her ability to, using structural formulas, draw and name three isomers when given the molecular formula. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 5% | 0% | 0% | 2% | | Level 2 | 0% | 0% | 16% | 5% | | Level 3 | 14% | 25% | 32% | 23% | | Level 4 | 81% | 75% | 53% | 70% | | N= | 21 | 20 | 19 | 60 | | Success | 95% | 100% | 100% | 98% | | | Over the 3-year assessment period, 98% performed at level 2 or better.  In every year the criterion for success was met.  We continue to use assigned online homework, with a high completion rate.  This concept is tested often during the semester. |
| CHM 105 Objective 2  The student will demonstrate knowledge of chemistry by his/her ability to, given a Fischer structure of a monosaccharide, draw both **α** – and **β**- Haworth structures | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 15% | 0% | 5% | | Level 1 | 15% | 15% | 0% | 10% | | Level 2 | 0% | 15% | 16% | 10% | | Level 3 | 10% | 15% | 11% | 12% | | Level 4 | 76% | 40% | 63% | 60% | | N= | 21 | 20 | 19 | 60 | | | Over the 3-year assessment period, 82% performed at level 2 or better.  The criterion for success was met every year. Because this concept is taught at the end of the semester, some students have more trouble than with other concepts. In the next assessment period, we plan to use molecular models in a lab exercise to reinforce this concept. |
| CHM 105 Objective 3  The student will demonstrate knowledge of chemistry by his/her ability to show how α-amino acids form peptide linkages. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 15% | 10% | 21% | 15% | | Level 2 | 0% | 10% | 11% | 7% | | Level 3 | 10% | 25% | 1% | 12% | | Level 4 | 76% | 55% | 63% | 67% | | N= | 21 | 20 | 19 | 60 | | | This question assesses problem solving and critical thinking skills  Over the 3-year assessment period, 82% performed at level 2 or better.  The criterion for success was met every year. This topic also arises late in the semester, and we plan to add a modeling unit to improve student understanding. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. This class is taught only in the summer session, because a large majority of the students are transients who are already at a 4-year institution. CHM 105 is required for several majors and is intended for sophomores, but most students put off the class until later in their college careers. Many of the students who come to us already attempted the course elsewhere without success. The key to fostering success in this course is to give students clear tasks and expectations, stressing the learning objectives, and urging the students to stay on schedule. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa A. Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM111**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Carry out calculations relating density, specific gravity, mass, and volume to one another  2. Determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass.  3. Given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated.  4. Use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature.  5. Draw the Lewis structure of a molecule or ion and predict its geometry.  6. Draw valid resonance structures including formal charges.  7. Use freezing point depression data to determine the molar mass of a substance. | | | | | |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | | **Use of Results** |
| CHM 111 Objective 1  The student will demonstrate his/her understanding of chemistry by being able to carry out calculations relating density, specific gravity, mass, and volume to one another | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 1% | 0% | 0% | | Level 1 | 4% | 5% | 2% | 4% | | Level 2 | 7% | 3% | 4% | 5% | | Level 3 | 14% | 16% | 7% | 12% | | Level 4 | 74% | 75% | 88% | 79% | | N= | 135 | 77 | 123 | 335 | | Success | 95% | 94% | 99% | 96% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  This question involves a concept that students perform in the lab. The mathematics are very simple.  In most sections, we have been using online homework, and give a preliminary math exam to the students on the first day. We assign extra online math problems to the students who show serious deficits. |
| CHM 111 Objective 2  The student will demonstrate his/her understanding of chemistry by being able to determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 3% | 1% | 95% | 4% | | Level 1 | 10% | 6% | 6% | 7% | | Level 2 | 13% | 12% | 15% | 13% | | Level 3 | 16% | 21% | 33% | 23% | | Level 4 | 59% | 60% | 41% | 53% | | N= | 135 | 77 | 123 | 335 | | Success | 88% | 93% | 89% | 89% | | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is a somewhat complex problem, and we go over it at length in all sections. It involves putting together several concepts. Although the steps to solve it can be memorized, student performance reflects their critical thinking abilities |
| CHM 111 Objective 3  The student will demonstrate his/her understanding of chemistry by being able to given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 2% | 1% | 2% | 2% | | Level 1 | 8% | 6% | 7% | 7% | | Level 2 | 7% | 6% | 19% | 11% | | Level 3 | 13% | 22% | 18% | 17% | | Level 4 | 70% | 64% | 54% | 63% | | N= | 135 | 77 | 123 | 335 | | Success | 90% | 92% | 91% | 91% | | | Over the 3-year assessment period, 91% performed at level 2 or better.  In every year the criterion for success was met.  Most students make only minor errors on this problem. The concept of solution stoichiometry and limiting reagent is introduced early in the semester.  Over the three years of the study, online homework stressing this type of problem has been used in most sections. Students who complete the homework perform better in exams. |
| CHM 111 Objective 4  The student will demonstrate his/her understanding of chemistry by being able to use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 2% | 1% | | Level 1 | 13% | 3% | 3% | 7% | | Level 2 | 8% | 6% | 7% | 7% | | Level 3 | 13% | 16% | 7% | 11% | | Level 4 | 65% | 73% | 81% | 73% | | N= | 135 | 77 | 123 | 335 | | Success | 86% | 95% | 95% | 91% | | | Over the 3-year assessment period, 91% performed at level 2 or better.  In every year the criterion for success was met.  This problem involves rather simple arithmetic and a low level of critical thinking. Many students who make errors in this problem have trouble using their calculators correctly (use of scientific notation and parentheses)  We have addressed this issue during the assessment period by having frequent calculator exercises in class. |
| CHM 111 Objective 5  The student will demonstrate his/her understanding of chemistry by being able to draw the Lewis structure of a molecule or ion and predict its geometry. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 2% | 1% | | Level 1 | 5% | 4% | 0% | 3% | | Level 2 | 3% | 4% | 7% | 5% | | Level 3 | 11% | 14% | 10% | 11% | | Level 4 | 80% | 75% | 81% | 79% | | N= | 135 | 77 | 123 | 335 | | Success | 94% | 93% | 98% | 96% | | | Over the 3-year assessment period, 96% performed at level 2 or better.  In every year the criterion for success was met.  Most students are able to draw the structure correctly in the exam, because they have to complete several similar problems in the online homework. |
| CHM 111 Objective 6  The student will demonstrate his/her understanding of chemistry by being able to draw valid resonance structures including formal charges | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 1% | 3% | 5% | 3% | | Level 1 | 20% | 4% | 5% | 11% | | Level 2 | 4% | 5% | 10% | 7% | | Level 3 | 23% | 29% | 20% | 23% | | Level 4 | 52% | 60% | 61% | 57% | | N= | 135 | 77 | 123 | 335 | | Success | 79% | 94% | 91% | 87% | | | Over the 3-year assessment period, 87% performed at level 2 or better.  In every year the criterion for success was met.  Most students are able to draw at least one of the two structures correctly in the exam, but either err in the assignment of charges, or in drawing the second structure. |
| CHM 111 Objective 7  The student will demonstrate his/her understanding of chemistry by being able to use freezing point depression data to determine the molar mass of a substance | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 10% | 3% | 11% | 9% | | Level 1 | 10% | 4% | 7% | 7% | | Level 2 | 7% | 3% | 16% | 9% | | Level 3 | 19% | 22% | 24% | 21% | | Level 4 | 56% | 69% | 41% | 53% | | N= | 135 | 77 | 123 | 335 | | Success | 82% | 94% | 81% | 84% | | | Over the 3-year assessment period, 84% performed at level 2 or better.  In every year the criterion for success was met.  This is a rather complex problem. It involves 4 steps. Although the steps to solve it can be memorized, student performance reflects critical thinking abilities This problem is taught during the last week of classes, and also is presented as a lab. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. In CHM 111, the key to success in the course is completion of a great deal of homework. Most sections that are taught at Jefferson State have mandatory online homework as part of the course grade. Students who complete most of the homework problems have success in the course, earning A’s and B’s. Many students resist buying the online homework because of the cost ($120/year), and some instructors resist requiring the online homework for the same reason, but there seems to be no other clear way to encourage completion of homework. While our students are required to have completed MTH 112 as a prerequisite, more than half of the students enter the class unprepared for simple algebra and exponents, based on their performance on an initial math assessment (MTH 100 level). Also, though this course is intended for students with a strong background in science and mathematics, about one fourth have not had high school chemistry. These students generally have problems with the class. | | | | | |
| **Plan submission date: September 27, 2019** | | | | **Submitted by: Lisa Nagy** | |

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| **Instructional Program Outcomes & Assessment Plan – CHM112**  **Chemistry Course Level Outcomes Assessment Rubric**  Level 4: Student provides a complete and correct solution process that is well organized, with no errors.  Level 3: Student provides a complete solution process that is well organized, but contains minor errors.  Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.  Level 1:  Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.  Level 0: Student does not attempt a solution.  **General Education Objective**  Students will use abstract ideas, symbols, and fundamental skills of chemistry to analyze and solve problems.  **Evaluated Course Objectives**  The student will demonstrate his/her understanding of chemistry by being able to:  1. Use Le Chatelier's Principle to predict the direction in which a system at equilibrium will shift (if it does) when stresses are applied.  2. Predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical.  3. Determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb  4. For a given redox reaction, use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species. |



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| CHM 112 Objective 2  The student will demonstrate his/her understanding of chemistry by being able to predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 5% | 5% | 0% | 3% | | Level 1 | 12% | 4% | 9% | 8% | | Level 2 | 12% | 4% | 3% | 5% | | Level 3 | 20% | 24% | 23% | 23% | | Level 4 | 51% | 62% | 65% | 61% | | N= | 41 | 74 | 77 | 192 | | Success | 83% | 90% | 91% | 89% | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is another qualitative question that assesses understanding of a basic concept. We reinforce this concept with a laboratory exercise.  For most students, any difficulty arises from the sign convention. |
| CHM 112 Objective 3  The student will demonstrate his/her understanding of chemistry by being able to determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 2% | 6% | 6% | 5% | | Level 1 | 10% | 4% | 6% | 6% | | Level 2 | 10% | 4% | 6% | 6% | | Level 3 | 20% | 19% | 17% | 18% | | Level 4 | 59% | 69% | 64% | 65% | | N= | 41 | 74 | 77 | 192 | | Success | 89% | 92% | 87% | 89% | | Over the 3-year assessment period, 89% performed at level 2 or better.  In every year the criterion for success was met.  This is a multi-step question that assesses ability to complete a complex calculation. We reinforce this concept with a laboratory exercise. |

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| CHM 112 Objective 4  The student will demonstrate his/her understanding of chemistry by being able to use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 5% | 4% | 8% | 6% | | Level 1 | 10% | 5% | 5% | 6% | | Level 2 | 10% | 5% | 3% | 5% | | Level 3 | 17% | 20% | 22% | 20% | | Level 4 | 59% | 65% | 62% | 63% | | N= | 41 | 74 | 77 | 192 | | Success | 86% | 91% | 87% | 88% | | | Over the 3-year assessment period, 88% performed at level 2 or better.  In every year the criterion for success was met.  We reinforce this concept with a laboratory exercise and parameterized homework problems. |
| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. In addition, we see improvement in the percentages of students achieving at level 3 or better. As in CHM 111, the key to success in the course is completion of a great deal of homework. During the 3-year assessment period, we introduced more analytical laboratories with quantitative data analysis. This was made possible by the purchase of automated laboratory data collection instrumentation. We hope to be able to continue improving the laboratory experience with this equipment. | | | | | |
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| CHM 221 Objective 2  The student will demonstrate knowledge of organic chemistry by his/her ability to propose structures for compounds, given their NMR, IR, and mass spectra | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 13% | 0% | 3% | | Level 1 | 13% | 0% | 15% | 10% | | Level 2 | 0% | 0% | 15% | 7% | | Level 3 | 25% | 25% | 39% | 31% | | Level 4 | 63% | 63% | 31% | 48% | | N= | 8 | 8 | 13 | 29 | | Success | 88% | 88% | 85% | 86% | | Over the 3-year assessment period, 86% performed at level 2 or better.  In every year the criterion for success was met.  This question assesses problem solving and critical thinking skills  The small class size allows discussion of the problems, and assignment of parameterized homework encourages practice. |
| CHM 221 Objective 3  The student will demonstrate knowledge of chemistry by his/her ability to calculate the degree of unsaturation of any compound, including those containing N, O, and halogens. | Rubric based assessment of related common final exam problems | 70% of students learning at a rubric level of 2 or higher | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Academic Year** | | | | |  | 2106-2017 | 2017-2018 | 2018-2019 | 2016-2019 | | Level 0 | 0% | 0% | 0% | 0% | | Level 1 | 0% | 0% | 0% | 0% | | Level 2 | 0% | 0% | 0% | 0% | | Level 3 | 0% | 0% | 23% | 10% | | Level 4 | 100% | 100% | 77% | 90% | | N= | 8 | 8 | 13 | 29 | | Success | 100% | 100% | 100% | 100% | | Over the 3-year assessment period, 100% performed at level 2 or better.  In every year the criterion for success was met.  This is an arithmetic question that assesses use of a general formula.  This concept is reviewed frequently during the semester. The small class size enables discussion. |

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| Reflections/Implications:  The intended success rates were met for each of the learning outcomes. Over the assessment period, we changed textbooks from McMurry to another author, Brown, because it had better explanations of kinetics and thermodynamics. Unfortunately, the homework problems were not as rigorous as in the previous text. The new edition of the McMurry book, adopted this year, has improved the treatment of these topics while maintaining challenging end-of-chapter problems. The size of this class is very small, and most of the students live closer to the Shelby campus, and would prefer that the course be taught there. We continue to try to actively recruit for this course. |

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