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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology (BIO 101)** |  **Assessment period:** | **Fall 2016 – Summer 2017** |

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| **Program or Department Mission:**  |

Program or Department Mission: The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters. |

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| **Course Student Learning Outcomes & Assessment Plan** **Biology 101 Course Level Assessment Rubric:** **General Education Objective**The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental,

 cellular, molecular, and organism levels. 3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community 4. Students will understand principles of human biology that relate to health and fitness**Course Level Student Learning Outcomes** 1. Students will recognize how the scientific method is utilized to explore and think critically about biological processes.

 2. Students will have the ability to recognize biological processes at the molecular, cellular and organismal levels. 3. Students will demonstrate an ability to identify basic anatomical structures and the correlating physiology of human systems. |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| 1. Students will recognize how the scientific method is utilized to explore and think critically about biological processes  | Student learning outcomes were assessed by using a 15 question standardized multiple choice examination at the end of the semester. A total of one question (Q-1) was used to assess SLO-1. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| Fall 2016 | Jefferson | # students tested = 38% correct = 71% |
|  | Shelby | # students tested = 0% correct = 0% |
|  | Pell City | # students tested = 24% correct = 45% |
|  | Clanton | # students tested = 18% correct = 67% |
| Spring 2017 | Jefferson | # students tested = 29% correct = 72% |
|  | Shelby | # students tested = 49% correct = 62% |
|  | Pell City | # students tested = 39% correct = 74% |
|  | Clanton | # students tested = 49% correct = 62% |
| Summer 2017 | Jefferson | # students tested = 15% correct = 79% |
|  | Shelby | # students tested = 37% correct = 62% |
|  | Pell City | # students tested = 0% correct = |
|  | Clanton | # students tested = 0% correct = |

**Total Students Tested = 298** **Total Annual Success Rate: 67.7%** | The students tested did not meet the requirements for success for SLO 1. The success rate for SLO 1 improved from 51% during the 13-14 academic year to 73% during the 14-15 academic year. It dipped back down to 66% in 2015-16 and has remained about the same in 2016-17. It has been suggested that the students did not want to take the assessment after their exam and therefore did not take it seriously. To address this we will continue to request that instructors offer nominal points for successful answers on the assessment. We will also continue to emphasize the scientific method throughout the lecture and lab portions of the course using classroom examples, case studies, and inquiry-based laboratory experiments.  |
| 2. Students will have the ability to recognize biological processes at the molecular, cellular and organismal levels  | Student learning outcomes were assessed by using a 15 question standardized multiple choice examination at the end of the semester. A total of ten questions (Q2-Q11) were used to assess SLO-2. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 2. |

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| Fall 2016 | Jefferson | # students tested = 38% correct = 70% |
|  | Shelby | # students tested = 0% correct = 0% |
|  | Pell City | # students tested = 24% correct = 42% |
|  | Clanton | # students tested = 18% correct = 67% |
| Spring 2017 | Jefferson | # students tested =29% correct = 68% |
|  | Shelby | # students tested = 49% correct = 67% |
|  | Pell City | # students tested = 39% correct = 74% |
|  | Clanton | # students tested = 49% correct = 67% |
| Summer 2017 | Jefferson | # students tested = 15% correct = 84% |
|  | Shelby | # students tested = 37% correct = 64% |
|  | Pell City | # students tested = 0% correct = |
|  | Clanton | # students tested = 0% correct = |

**Total Students Tested = 298** **Total Annual Success Rate: 67.4%** | The students tested did not meet the requirement for success for SLO 2. This is a higher compared with 2015-2016 which was at 58% success. We will continue to implement case studies as a teaching tool and small group review projects for the students. The idea behind the case studies is to show the students the relevance of the material to their every day life. The small group reviews will put the onus on the students to prepare the review materials, forcing them to become experts in at least one of the topics.  |
| 3. Students will demonstrate an ability to identify basic anatomical structures and the correlating physiology of human systems | Student learning outcomes were assessed by using a 15 question standardized multiple choice examination at the end of the semester. A total of four questions (Q12-Q15) were used to assess SLO-3. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 3. |

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| Fall 2016 | Jefferson | # students tested = 38% correct = 41% |
|  | Shelby | # students tested = 0% correct = 0% |
|  | Pell City | # students tested = 24% correct = 40% |
|  | Clanton | # students tested = 18% correct = 57% |
| Spring 2017 | Jefferson | # students tested = 29% correct = 46% |
|  | Shelby | # students tested = 49% correct = 54% |
|  | Pell City | # students tested = 39% correct = 56% |
|  | Clanton | # students tested = 49% correct = 54% |
| Summer 2017 | Jefferson | # students tested = 15% correct = 79% |
|  | Shelby | # students tested = 37% correct = 45% |
|  | Pell City | # students tested = 0% correct = |
|  | Clanton | # students tested = 0% correct = |

**Total Students Tested = 298** **Total Annual Success Rate: 54%** | The students tested did not meet the requirement for success for SLO 3. The success rate is the same as 2015-16 but a significant decline when compared with the data from 2013-2014 and 2014-2015, both of which had 59% success. Instructors are encouraged to emphasize the general structure/function of each organ system prior to incorporating more difficult biological concepts. Models and dissection specimens from the anatomy and physiology lab will be used during lecture to emphasize anatomical structures and concepts.  |
| **Plan submission date:**  | **Submitted by: Meena Bej** |
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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology (BIO 102)** |  **Assessment period:** | **Fall 2016 – Summer 2017** |

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| **Program or Department Mission:**  |
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| **Program or Department Mission:**  |

The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters. |

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| **Course Student Learning Outcomes & Assessment Plan****Biology 102 Course Level Assessment Rubric:** **General Education Objective**The student will read, understand, and evaluate materials written at a variety of levels and for a variety of purposes.**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental,

 cellular, molecular, and organism levels. 3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community 4. Students will understand principles of human biology that relate to health and fitness**Course level student learning outcomes** 1. Students will demonstrate knowledge of evolution in both plant of animal life.
2. Students will identify general characteristics, anatomy, and taxonomy of plant and animals.
3. Students will explain the interrelationships between the varied life forms on earth and identify the role of humans within ecological systems.
 |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| 1. Students will demonstrate knowledge of evolution in both plant of animal life. | Student learning outcomes were assessed by using a 25 question standardized multiple choice examination at the end of the semester. A total of 7 questions (Q1-Q7) were used to assess SLO 1.  | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| Fall 2016 | Jefferson | # students tested = 15% correct = 91% |
|  | Shelby | # students tested = 21% correct = 87% |
| Spring 2017 | Jefferson | # students tested =13% correct = 82% |
|  | Shelby | # students tested = 51% correct = 69% |

**Total Students Tested = 100** **Total Annual Success Rate: 78%** | Collegewide, students were successful in meeting the 70% benchmark for success for SLO 1. The results reveal a 10% increase when compared to 2015-2016 academic year. Student performance at both campuses improved between 3% - 23%. Although the Shelby campus results from the Spring semester were one point below 70% benchmark, there was an increase in student performance when compared to previous year’s results. Shelby instructors will continue to implement strategies to help improve students understanding of foundational evolutionary concepts.  |
| 2. Students will identify general characteristics, anatomy, and taxonomy of plant and animals. | Student learning outcomes were assessed by using a 25 question standardized multiple choice examination at the end of the semester. A total of 14 questions (Q8-Q20)were used to assess SLO 2. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 2. |

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| Fall 2016 | Jefferson | # students tested = 15% correct = 83% |
|  | Shelby | # students tested = 21% correct = 76% |
| Spring 2017 | Jefferson | # students tested = 13% correct = 80% |
|  | Shelby | # students tested = 51# questions = 714# questions correct = 495# questions incorrect = 219% correct = 69% |

**Total Students Tested = 100** **Total Annual Success Rate: 74%** | Collegewide, students were successful in meeting the 70% benchmark for success for SLO 2. Overall, student performance improved at both campuses when compared to the previous academic year. Most notably, the Spring results from the Jefferson campus show an improvement of 20% when compared to the previous year’s data. However, the Shelby campus experienced a slight decrease in the Spring with a 3% difference when compared to Spring 2016 results. This learning outcome covers material that requires students to recall, duplicate, or list facts and basic concepts related to animal and plant structure and classification. Instructors will continue to strengthen student performance. through lecture and laboratory experiences.  |
| 3. Students will explain the interrelationships between the varied life forms on earth and identify the role of humans within ecological systems.  | Student learning outcomes were assessed by using a 25 question standardized multiple choice examination at the end of the semester. A total of 4 questions (Q21-Q25) were used to assess SLO 3. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 3. |

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| Fall 2016 | Jefferson | # students tested = 15# questions = 60# questions correct = 50# questions incorrect = 10% correct = 83% |
|  | Shelby | # students tested = 21# questions = 84# questions correct = 52# questions incorrect = 32% correct = 62% |
| Spring 2017 | Jefferson | # students tested = 13# questions = 52# questions correct = 38# questions incorrect = 14% correct = 73% |
|  | Shelby | # students tested = 51# questions = 204# questions correct = 121# questions incorrect = 83% correct = 59% |

**Total Students Tested = 100** **Total Annual Success Rate: 64%** | Collegewide, students were unsuccessful in meeting the 70% benchmark for success for SLO 3. Overall, student success decreased by success is 3% points lower when compared to the previous academic year. A 3% difference was noted in the previous year which indicates, the department results are trending downward. Steps to improve student performance through integrating and applying concepts to relevant ecological problems will be introduced via case studies. |
| **Plan submission date: Plan submission date: 9/8/17** | **Submitted by: Nakia R. Robinson** |

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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology ( BIO 103)** |  **Assessment period:** | **Fall 2016 – Summer 2017** |

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| **Program or Department Mission:**  |
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| Program or Department Mission:  |

The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters. |

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| **Course Student Learning Outcomes & Assessment Plan****Biology 103 Course Level Assessment Rubric:** **General Education Objective** The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.1. Students will understand the fundamental principles of biology at the elemental, cellular, molecular, and organism levels
2. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness communit
3. Students will understand principles of human biology that relate to health and fitness

**Course Level Student Learning Outcomes** 1. Students will demonstrate an ability to engage in scientific inquiry as it relates to biological concepts, phenomenon, and literacy.
2. Students will demonstrate an ability to identify molecular and cellular processes in prokaryotic and eukaryotic cells.
3. The student will demonstrate an ability to recognize genetic, morphological and life cycle characteristics of bacteria, fungi, and viruses.
 |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence**  | **Use of Results** |
| 1:Students will demonstrate an ability to engage in scientific inquiry as it relates to biological concepts, phenomenon, and literacy.  | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of four questions (Q1 – Q4) were used to assess SLO1 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO1 |

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| Fall 2016 | Jefferson  | # students tested = 68% correct = 83% |
|  | Shelby | NA |
|  | Pell City  | # students tested = 27% correct = 69% |
|  | Clanton | # students tested = 24% correct = 78% |
| Spring 2017 | Jefferson  | # students tested = 33% correct = 88% |
|  | Shelby  | # students tested = 76% correct = 79% |
|  | Pell City  | # students tested = 9% correct = 50% |
|  | Clanton  | # students tested = 21% correct = 83% |
| Summer 2017 | Jefferson | # students tested = 30% correct = 94% |
|  | Shelby | # students tested = 33% correct = 67% |
|  | Pell City | NA  |
|  | Clanton | # students tested = 12% correct = 67% |

**Total Students Tested = 333 Total Annual Success Rate: 77.6%** | The students tested met the requirement for success for SLO 1. We continue to do a review of chemistry as part of the final review and that has helped retention and comprehension. Question #3 remains the lowest scoring item (understanding isotopes) with 53% success overall. This is nomenclature and the instructors need to continue to use new terminology throughout the course. We suggest continuing with the chemistry reviews and practice on vocabulary and concepts as appropriate. |
| 2:Students will demonstrate an ability to identify molecular and cellular processes in prokaryotic and eukaryotic cells. | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of seven questions (Q5 – Q11) were used to assess SLO2 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO2 |

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| Fall 2016 | Jefferson  | # students tested = 68% correct = 52% |
|  | Shelby | NA |
|  | Pell City  | # students tested = 27% correct = 56% |
|  | Clanton  | # students tested = 24% correct = 55% |
| Spring 2017 | Jefferson  | # students tested = 33% correct =79% |
|  | Shelby  | # students tested = 76% correct = 58% |
|  | Pell City  | # students tested = 9% correct = 40% |
|  | Clanton  | # students tested = 21% correct = 60% |
| Summer 2017 | Jefferson | # students tested = 30% correct = 90% |
|  | Shelby | # students tested = 33% correct = 63% |
|  | Pell City | NA  |
|  | Clanton | # students tested = 12% correct = 43% |

**Total Students Tested =333Total Annual Success Rate: 60.4%** | The students tested did not meet the requirement for success for SLO 2. Question 9 (regarding phenotypic ratios) is still one of the lower scoring questions. This indicates that students need more practice with genetic terminology and problems . Students also score low on question 5 which deals with respiration. One solution would be to implement quizzes over the various respiration processes, fostering understanding of the individual pathways. Assigning the viewing of certain online videos on respiration could also facilitate learning. Both respiration and genetics should be reviewed before the final exam to help students retain this mid- semester information. Considering the difference in scores between campuses with all fulltime instructors (Jefferson spring 2016) teaching and those with all part time instructors (Shelby, Clanton, and Pell city spring 2016) teaching, the department as a whole may need to do more mentoring of adjuncts about the importance of teaching key concepts. A suggestion to be considered by the department is to prepare a video for adjuncts concerning the importance of the SLOs and some suggestions for teaching the topics to help students to comprehend and retain the key topics of biology. Such a video could be posted on Blackboard with adjuncts being asked to view it and give some feedback as to whether or not it was helpful. Many of our adjuncts teach at times when they have little contact with the full time faculty. We need to consider how to encourage and mentor this part of our faculty . |
| 3:The student will demonstrate an ability to recognize genetic, morphological and life cycle characteristics of bacteria, fungi, and viruses.  | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of one question (Q12) was used to assess SLO3 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered question related to SLO3 |

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| Fall 2016 | Jefferson FT | # students tested = 68% correct = 66% |
|  | Shelby | NA |
|  | Pell City FT | # students tested = 27% correct = 70% |
|  | Clanton PT | # students tested = 24% correct = 79% |
| Spring 2017 | Jefferson FT | # students tested = 33% correct =82% |
|  | Shelby PT | # students tested = 76% correct = 68% |
|  | Pell City FT | # students tested = 9% correct = 22% |
|  | Clanton PT | # students tested = 21% correct = 86% |
| Summer 2017 | Jefferson | # students tested = 30% correct = 93% |
|  | Shelby | # students tested = 33% correct = 45% |
|  | Pell City | NA |
|  | Clanton | # students tested = 12% correct = 50% |

**Total Students Tested = 333Total Annual Success Rate: 65.6%** | The students tested did not meet the requirement for success for SLO 3. The assessment was updated to include two more questions for this SLO (taking it from one question to three). This does not appear to have changed the success rate of this SLO. This material falls at the end of the semester, which may lead to only partial coverage. Efforts will be made to ensure a more complete coverage.  |
| Plan submission date: September 20, 2017 |  |  | **Submitted by:** M. Ross, A. Swindall  |  |
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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology ( BIO 104)** |  **Assessment period:** | **Fall 2016 –Summer 2017** |

**Program or Department Mission:**

The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters.

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| **Course Student Learning Outcomes & Assessment Plan****Biology 104 Course Level Assessment Rubric:** **General Education Objective**The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes** 1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental, cellular, molecular, and organism level
3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community
4. Students will understand principles of human biology that relate to health and fitness

**Course Level Student Learning Outcomes** 1. The student will recognize the fundamental principles and supporting evidence necessary to explain Darwinian evolution.
2. The student will demonstrate an ability to identify the structural characteristics and life cycles of both plant and animal phyla.
3. The student can recognize components of community ecology and identify how biodiversity contributes to a stable ecosystem.
 |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| 1. The student will recognize the fundamental principles and supporting evidence necessary to explain Darwinian evolution. | Student learning outcomes were assessed using a 20 question multiple-choice assessment at the end of each semester. A total of 6 questions (Q1-Q6) were used to assess understanding of SLO1 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions (1 to 6) related to SLO 1. (6 questions) |

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| Fall 2016 | Jefferson | # students tested = 19 correct = 70% |
| Spring 2017 | Jefferson | # students tested = 19% correct = 81% |
| Spring 2017 | Shelby | # students tested = 27**% correct = 51%** |
| Summer 2017 | Jefferson | # students tested = 6 % correct = 76% |
| Summer2017 | Shelby | **Not reported** |

**Total Students Tested = 71****Total Annual Success Rate = 66%** | The students tested did not meet the requirement for success for SLO1. The overall success rate for SLO1 decreased by 2% as compared to 2015-2016. Comparing all three BIO 104S SLOs reveals a continued lack of success (< 70%) in data reported by Part Time (PT) instructors. We did not start a mentoring program as proposed in the 2015-16 report. The organization of JSCC into separate campuses creates a vertical hierarchy that is not conducive for faculty to evaluate and mentor junior colleagues at other campuses. It is difficult to establish a "need" to improve PT performance given a single data set (BIO 104S). Thus I propose a broad longitudinal analyses of SLO data to determine if there is a difference (p < 0.05) between full-time and part-time faculty, which may than be presented to the JSCC Administration. |
| 2. The student will demonstrate an ability to identify the structural characteristics and life cycles of both plant and animal phyla. | Student learning outcomes were assessed using a 20 question multiple-choice assessment at the end of each semester. A total of 9 questions (Q7-Q12, Q18 - Q20) were used to assess mastery of SLO2 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions (7 to 12 and 18 to 20) related to SLO 2.(9 total) |

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| Fall 2016 | Jefferson | # students tested = 19% correct = 75% |
| Spring 2016 | Jefferson  | # students tested = 19% correct = 88% |
| Spring 2016 | Shelby | # students tested = 27**% correct = 66%** |
| Summer 2016 | Jefferson | # students tested = 6**% correct = 64%** |
| Summer 2016 | Shelby | **Not reported** |

**Total Students Tested = 71****Total Annual Success Rate** = **74%** | The students tested did meet the requirement for success for SLO2. The overall success rate for SLO2 increased by 5% as compared to 2014-2015. This was likely due to the full time instructor further implementing changes suggested in our 2014-2015 report, including an emphasis on structure. |
| 3. The student can recognize components of population and community ecology and identify how biodiversity contributes to a stable ecosystem. | Student learning outcomes were assessed using a 20 question multiple-choice assessment at the end of each semester. A total of 5 questions (Q13-Q17) were used to assess mastery of SLO3  | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions (13 to 17) related to SLO 3. (5 total) |

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| Fall 2016 | Jefferson(FT)  | # students tested = 19% correct = 74% |
| Spring 2016 | Jefferson(FT)  | # students tested = 19% correct = 77% |
| Spring 2016 | Shelby(PT) | # students tested = 27**% correct = 50%** |
| Summer 2016 | Jefferson(FT) | # students tested = 6% correct = 70% |
| Summer 2016 | Shelby(PT) | **Not reported** |

**Total Students Tested = 71****Total Annual Success Rate = 65%** | The students tested did not meet the requirement for success for SLO3. The overall success rate for SLO1 decreased by 4% as compared to 2014-2015. There has been a continued improvement in the students grasp of Ecology in 3 of 4 classes due to suggestions made in 2014-15. Note the overall measure of success did not achieve 70% due to the one class taught by a part time instructor. (see above) ***Finally the lack of data collection for the same instructor, two years in a row is very concerning, especially given the paucity of classes offered.*** |
| **Plan submission date: 09/13/2017** | **Submitted by: Charles Venglarik** |

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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology (BIO 201)** |  **Assessment period:** | **Fall 2016 – Summer 2017** |

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| **Program or Department Mission:**  |

Program or Department Mission: The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters |

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| **Course Student Learning Outcomes & Assessment Plan****Biology 201 Course Level Assessment Rubric:** **General Education Objective**The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental,

 cellular, molecular, and organism levels. 3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community 4. Students will understand principles of human biology that relate to health and fitness**Course Level Student Learning Outcomes Assessed**1. Students will be able to identify the terminology used in anatomy and physiology
2. Students will be able to identify and recognize the distinct characteristics of the systems listed below

A. Integumentary SystemB. Skeletal SystemC. Muscular SystemD. Nervous System1. Students will recognize the relationship between structural organization and function
2. Student will define homeostasis and identify the role of homeostasis within and between appropriate systems

5. Students will identify the major structures of each systemA. Integumentary SystemB. Skeletal SystemC. Muscular SystemD. Nervous System |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| SLO 1: Students will be able to identify the terminology used in anatomy and physiology | Student learning outcomes were assessed by using a 16 question standardized multiple choice examination at the end of the semester. A total of 2 questions (Q2 and Q3) were used to assess SLO1 | Correct responses by 70% of the students for each SLO will be defined as a successful outcome. |

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| Fall 2016 | Jefferson | # students tested = 74% correct = 82% |
|  | Shelby | # students tested = 174% correct = 72% |
|  | Clanton | # students tested = 42% correct = 88% |
|  | Pell City | # students tested = 75% correct = 73% |
| Spring 2017 | Jefferson | # students tested = 91% correct = 80% |
|  | Shelby | # students tested = 136% correct = 74% |
|  | Clanton | # students tested = 19% correct = 82% |
|  | Pell City | # students tested = 24% correct = 60% |
| Summer 2017 | Jefferson | # students tested = 49% correct = 91% |
|  | Shelby | # students tested = 46% correct = 90% |
|  | Clanton | # students tested = 0% correct =  |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 730****Total Annual Success Rate = 79.2%** | All campuses and semesters evaluated were greater than 70%, except the Pell City Campus (Spring 17). This was an overall increase from 2015-16 due to the new updated SLO questions to better reflect material covered in the course. Instructors made better use of the vocabulary terms throughout each chapter to reinforce the terms and utilized vocabulary, regional, and directional terms throughout the course rather than the first portion of the semester. Terminology and etiology was emphasized throughout the semester. Faculty continued to reinforce the relationship between structure and function.In regard to Pell City, starting in Spring 2017, the Pell City campus began using more Biology 201 adjunct instructors in order to 1. Offer more sections and 2. The full time Biology Instructor took on the role of the lab coordinator, so more 201’s were taught by adjuncts. Efforts will be made to make adjunct instructors aware of the department SLO’s and methods to improve instruction of SLO’s. |
| SLO 2: Students will be able to identify and recognize the distinct characteristics of the systems listed below * 1. Integumentary System
	2. Skeletal System
	3. Muscular System
	4. Nervous System
 | Student learning outcomes were assessed by using a 16 question standardized multiple choice examination at the end of the semester. A total of 7 questions (Q5, Q8, Q11, and Q14) were used to assess SLO2 | Correct responses by 70% of the students for each SLO will be defied as a successful outcome. |

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| Fall 2016 | Jefferson | # students tested = 74% correct = 85% |
|  | Shelby | # students tested = 174% correct = 81% |
|  | Clanton | # students tested = 42% correct = 80% |
|  | Pell City | # students tested = 75% correct = 60% |
| Spring 2017 | Jefferson | # students tested = 91% correct = 82% |
|  | Shelby | # students tested = 136% correct = 74% |
|  | Clanton | # students tested = 19% correct = 83% |
|  | Pell City | # students tested = 24% correct = 39% |
| Summer 2017 | Jefferson | # students tested = 49% correct = 81% |
|  | Shelby | # students tested = 46% correct = 76% |
|  | Clanton | # students tested = 0% correct =  |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 730****Total Annual Success Rate = 74.1 %** | All campuses and semesters evaluated were greater than 70%, except the Pell City Campus (Spring 17). This was an overall increase from 2015-16 due to the new updated smaller number of SLO questions on SLO2. Faculty continued to stress the details of each organ system throughout the semester. In regard to Pell City, starting in Spring 2017, the Pell City campus began using more Biology 201 adjunct instructors in order to 1. Offer more sections and 2. The full time Biology Instructor took on the role of the lab coordinator, so more 201’s were taught by adjuncts. Efforts will be made to make adjunct instructors aware of the department SLO’s and methods to improve instruction of SLO’s. |
| SLO 3: Students will recognize the relationship between structural organization and function  | Student learning outcomes were assessed by using a 16 question standardized multiple choice examination at the end of the semester. A total of 1 question (Q1, Q7, Q9, Q13) was used to assess SLO3 | Correct responses by 70% of the students for each SLO will be defied as a successful outcome. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students tested = 74% correct = 59% |
|  | Shelby | # students tested = 174% correct = 52% |
|  | Clanton | # students tested = 42% correct = 61% |
|  | Pell City | # students tested = 75% correct = 42% |
| Spring 2017 | Jefferson | # students tested = 91% correct = 53% |
|  | Shelby | # students tested = 136% correct = 55% |
|  | Clanton | # students tested = 19% correct = 64% |
|  | Pell City | # students tested = 24% correct = 33% |
| Summer 2017 | Jefferson | # students tested = 49% correct = 86% |
|  | Shelby | # students tested = 46% correct = 61% |
|  | Clanton | # students tested = 0% correct =  |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 730****Total Annual Success Rate = 56.6%** | All campuses and semesters evaluated were less than 70%. This was an overall decrease from 2015-16. Instructors referred to the structure/function relationship as well as organization of life during each chapter of the course rather than only in the first chapter. There was only one question for SLO 3 in previous years, so we added three more questions to SLO3 to further examine this SLO. Students are still less than 70%, so we will continue to stress the importance of structure and function throughout each chapter. |
| SLO 4: Student will define homeostasis and identify the role of homeostasis within and between appropriate systems  | Student learning outcomes were assessed by using a 16 question standardized multiple choice examination at the end of the semester. A total of 2 questions (Q15 and Q16) were used to assess SLO4 | Correct responses by 70% of the students for each SLO will be defied as a successful outcome. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students tested = 74% correct = 94% |
|  | Shelby | # students tested = 174% correct = 81% |
|  | Clanton | # students tested = 42% correct = 98% |
|  | Pell City | # students tested = 75% correct = 70% |
| Spring 2017 | Jefferson | # students tested = 91% correct = 94% |
|  | Shelby | # students tested = 136% correct = 89% |
|  | Clanton | # students tested = 19% correct = 95% |
|  | Pell City | # students tested = 24% correct = 54% |
| Summer 2017 | Jefferson | # students tested = 49% correct = 99% |
|  | Shelby | # students tested = 46% correct = 92 |
|  | Clanton | # students tested = 0% correct =  |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 730****Total Annual Success Rate = 86.6%** | All campuses and semesters evaluated were greater than 70%, except the Pell City Campus (Spring 17). This was an overall increase from 2015-16 due to the new updated SLO questions to better reflect material covered in the course. These results are consistent with data from the previous year (2015-2016) where 87% of students were successful We will continue to stress the importance of homeostasis in each organ system. Currently the concept of homeostasis is stressed in each chapter, so this promotes understanding throughout the semester.In regard to Pell City, starting in Spring 2017, the Pell City campus began using more Biology 201 adjunct instructors in order to 1. Offer more sections and 2. The full time Biology Instructor took on the roll of the lab coordinator, so more 201’s were taught by adjuncts. Efforts will be made to make adjunct instructors aware of the department SLO’s and methods to improve instruction of SLO’s. |
| SLO 5: Students will identify the major structures of each systemA.Integumentary SystemB.Skeletal SystemC.Muscular SystemD.Nervous System | Student learning outcomes were assessed by using a 16 question standardized multiple choice examination at the end of the semester. A total of 4 questions (Q4, Q6, and Q10, Q12) were used to assess SLO5 | Correct responses by 70% of the students for each SLO will be defied as a successful outcome. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students tested = 74% correct = 81 |
|  | Shelby | # students tested = 174% correct = 80 |
|  | Clanton | # students tested = 42% correct = 82 |
|  | Pell City | # students tested = 75% correct = 72 |
| Spring 2017 | Jefferson | # students tested = 91% correct = 85 |
|  | Shelby | # students tested = 136% correct = 71 |
|  | Clanton | # students tested = 19% correct = 72 |
|  | Pell City | # students tested = 24% correct = 54 |
| Summer 2017 | Jefferson | # students tested = 49% correct = 85 |
|  | Shelby | # students tested = 46% correct = 86 |
|  | Clanton | # students tested = 0% correct =  |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 730****Total Annual Success Rate = 76.8%** | All campuses and semesters evaluated were greater than 70%, except the Pell City Campus (Spring 17). This was an overall increase from 2015-16 due to the new updated SLO questions to better reflect material covered in the course. Instructors continued to teach the major structures of each organ system and focus on the relationship between structure and function. Structure and function will be more emphasized in lab.In regard to Pell City, starting in Spring 2017, the Pell City campus began using more Biology 201 adjunct instructors in order to 1. Offer more sections and 2. The full time Biology Instructor took on the role of the lab coordinator, so more 201’s were taught by adjuncts. Efforts will be made to make adjunct instructors aware of the department SLO’s and methods to improve instruction of SLO’s. |
| **Plan submission date: 9/19/17** | **Submitted by: Brenda Hammer and Julie Maharrey** |

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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology (BIO 202)** |  **Assessment period:** | **Fall 2016- Summer 2017** |

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| **Program or Department Mission:**  |

Program or Department Mission: The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters. |

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| **Course Student Learning Outcomes & Assessment Plan****Biology 202 Course Level Assessment Rubric:** **General Education Objective**The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental,

 cellular, molecular, and organism levels. 3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community 4. Students will understand principles of human biology that relate to health and fitness**Course Level Student Learning Outcomes Assessed**1. Students will define and describe the systems listed below.
2. Endocrine System
3. Cardiovascular System
4. Lymphatic and Immune System
5. Respiratory System
6. Digestive System
7. Urinary System
8. Reproductive System
9. Students will define homeostasis and identify the role of homeostasis within and between appropriate systems.
10. Students will be able to recognize the major structures of each system listed below.
11. Endocrine System
12. Cardiovascular System
13. Lymphatic and Immune System
14. Respiratory System
15. Digestive System
16. Urinary System
17. Reproductive System
 |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| 1: Students will define and describe the systems listed below.1. Endocrine System
2. Cardiovascular System
3. Lymphatic and Immune System
4. Respiratory System
5. Digestive System
6. Urinary System
7. Reproductive System
 | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of five questions (Q2, Q4, Q7, Q8, Q12) were used to assess SLO1. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students tested = 41% correct = 79% |
|  | Shelby | # students tested = 94% correct = 74% |
|  | Clanton | # students tested = 18% correct = 74% |
|  | Pell City | # students tested = 33% correct = 67% |
| Spring 2017 | Jefferson | # students tested = 69% correct =74% |
|  | Shelby | # students tested = 133% correct = 69% |
|  | Clanton | # students tested = 45% correct = 60% |
|  | Pell City | # students tested = 57% correct = 71% |
| Summer 2017 | Jefferson | # students tested = 42% correct = 79% |
|  | Shelby | # students tested = 27% correct = 73% |
|  | Clanton | # students tested = 18% correct = 67% |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 582****Total Annual Success Rate = 70%** | The students tested met the requirement for success for SLO1.This is a marked improvement from the past three years where success was approximately 61%. The assessment given was edited this year and two of the questions for this SLO were edited for clarity. This could be cause for the increase in student success.  |
| 2: Students will define homeostasis and identify the role of homeostasis within and between appropriate systems. | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of 2 questions (Q1 and Q6) were used to assess SLO2. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO2. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students tested = 41% correct = 82% |
|  | Shelby | # students tested = 94% correct = 91% |
|  | Clanton | # students tested = 18% correct = 58% |
|  | Pell City | # students tested = 33% correct = 77% |
| Spring 2017 | Jefferson | # students tested = 69% correct = 78% |
|  | Shelby | # students tested = 133% correct = 82% |
|  | Clanton | # students tested = 45% correct = 52% |
|  | Pell City | # students tested = 57% correct = 70% |
| Summer 2017 | Jefferson | # students tested = 42% correct = 80% |
|  | Shelby | # students tested = 27% correct = 80% |
|  | Clanton | # students tested = 18% correct = 58% |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 582****Total Annual Success Rate = 73%** | The students tested met the requirement for success for SLO2. This data is consistent with the data for the past three years. It should also be noted that students are assessed on this same learning objective in BIO 201 and are also successful. We will continue to stress the role of each organ system in contributing to homeostasis.  |
| 3: Students will be able to recognize the major structures of each system listed below.1. Endocrine System
2. Cardiovascular System
3. Lymphatic and Immune System
4. Respiratory System
5. Digestive System
6. Urinary System
7. Reproductive System
 | Student learning outcomes were assessed by using a 12 question standardized multiple choice examination at the end of the semester. A total of 5 questions (Q3, Q5 and Q9-Q11) were used to assess SLO3. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO3. |

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| Fall 2016 | Jefferson | # students tested = 41% correct = 88% |
|  | Shelby | # students tested = 94% correct = 91% |
|  | Clanton | # students tested = 18% correct = 84% |
|  | Pell City | # students tested = 33% correct = 78% |
| Spring 2017 | Jefferson | # students tested = 69% correct = 89% |
|  | Shelby | # students tested = 133% correct = 88% |
|  | Clanton | # students tested = 45% correct = 76% |
|  | Pell City | # students tested = 57% correct = 76% |
| Summer 2017 | Jefferson | # students tested = 42% correct = 86% |
|  | Shelby | # students tested = 27% correct = 92% |
|  | Clanton | # students tested = 18% correct = 90% |
|  | Pell City | # students tested = 0% correct =  |

**Total Students Tested = 582****Total Annual Success Rate = 82%** | The students tested met the requirement for success for SLO2. This is consistent with the data over the past three years where each year we see a slight increase in successful mastery of this objective - 72% (2013-14) to 74% (2014-15) to 77% (2015-16). SLO3 deals with the anatomy of the various organ systems. We take a hands on approach in lab to ensure students have mastered the concepts and we will try to increase mastery by updating some of our models and animal organs.We have also slightly revised this portion of the assessment to make sure the questions are truly testing recognition. We have added pictures in which structures need to be identified instead of simply using word descriptions.  |
| **Plan submission date: August 29, 2017** | **Submitted by: Tom Baker**  |

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| jscc logo | **Assessment Record** |

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| **Program:** | **Biology (BIO 220)** |  **Assessment period:** | **Fall 2016- Summer 2017** |

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| **Program or Department Mission:**  |

The mission of the Biology Department is consistent with the mission of Jefferson State Community College. The department provides biology courses appropriate for students majoring in both science and non-science disciplines. Our teaching aims to help prepare students for their future professions both inside and outside of the scientific field and also to be a more informed member of their community, able to make responsible decisions in biological matters. |

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| **Course Student Outcomes & Assessment Plan****Biology 220 Course Level Assessment Rubric:** **General Education Objective**The student will demonstrate ability to apply reasoning and logic to assess ideas and situations, support positions, draw conclusions, and solve problemsThe student will demonstrate understanding of mathematical concepts and scientific principles, and ability to use computers**Department Level Student Learning Outcomes**1. Students will understand the principles and processes that are fundamental to life.
2. Students will understand the fundamental principles of biology at the elemental,

 cellular, molecular, and organism levels. 3. Students will receive the appropriate Biological knowledge to support a career within the Scientific, Medical, or Health and Fitness community 4. Students will understand principles of human biology that relate to health and fitness**Course Level Student Learning Outcomes Assessed**1. Students will be able to identify the differences between prokaryotic and eukaryotic cells as well as the structure and function of microorganisms in various environments.
2. Students will recognize the metabolic and genetic pathways in microorganisms as well as the clinical and industrial applications of these properties.
3. Students will be able to identify the relationship between microorganism infection and disease, interactions with the host immune system, and various methods for controlling the growth and dissemination of microorganisms.
4. Students will be able to recognize proper laboratory technique and protocols including aseptic technique, media selection, slide preparation, and microscopy.

 |
| **Intended Outcomes** | **Means of Assessment** | **Criteria for Success** | **Summary & Analysis of Assessment Evidence** | **Use of Results** |
| 1. Students will be able to identify the differences between prokaryotic and eukaryotic cells as well as the structure and function of microorganisms in various environments.
 | Student learning outcomes were assessed by using a 13 question standardized multiple choice examination at the end of the semester. A total of two questions (Q1 and Q2) were used to assess SLO-1. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students = 57% correct = 80% |
|  | Shelby | # students = 54% correct = 42% |
|  | Clanton | # students = 17% correct = 56% |
|  | Pell City | # students = 18% correct = 56% |
| Spring 2017 | Jefferson | # students = 89% correct = 88% |
|  | Shelby | # students = 48% correct = 53% |
|  | Clanton | # students = 15% correct = 63% |
|  | Pell City | # students = 27% correct = 48% |
| Summer 2017 | Jefferson  | # students = 63% correct = 75% |
|  | Shelby  | # students = 36% correct = 50% |
|  | Clanton  | # students = 19% correct = 42% |
|  | Pell City  | # students = None% correct = |

**Total Students Tested = 443****Total Annual Success Rate = 65%** | The students tested did not meet the requirement for success for SLO1(65%). This was a drop in intended outcome from the previous year (2015-2016 70.5%). Students are not required to take a general biology course as a prerequisite and therefore have a limited foundation of cell biology knowledge. Application of previous recommendations, in which faculty stressed basic cell biology and worked to reinforce lab concepts in lecture to help students better understand cellular processes; specific goals were not met. |
| 2. Students will recognize the metabolic and genetic pathways in microorganisms as well as the clinical and industrial applications of these properties. | Student learning outcomes were assessed by using a 13 question standardized multiple choice examination at the end of the semester. A total of three questions (Q3 - Q5) were used to assess SLO2. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students = 57% correct = 94% |
|  | Shelby | # students = 54% correct = 77% |
|  | Clanton | # students = 17% correct = 51% |
|  | Pell City | # students = 18% correct = 70% |
| Spring 2017 | Jefferson | # students = 89% correct = 88% |
|  | Shelby | # students = 48% correct = 79% |
|  | Clanton | # students = 15% correct = 60% |
|  | Pell City | # students = 27% correct = 81% |
| Summer 2017 | Jefferson  | # students = 63% correct = 76% |
|  | Shelby  | # students = 36% correct = 65% |
|  | Clanton  | # students = 19% correct = 72% |
|  | Pell City  | # students = None% correct = |

**Total Students Tested = 443****Total Annual Success Rate = 78%** | The students tested met the requirement for success for SLO2(78%). The success rate for SLO2 had a slight dip from the prior year (80.9%) 2015-2016; Since the drop was negligible, we will continue to emphasize bacterial metabolic processes during the course of each semester. |
| 3. Students will be able to identify the relationship between microorganism infection and disease, interactions with the host immune system, and various methods for controlling the growth and dissemination of microorganisms.  | Student learning outcomes were assessed by using a 13 question standardized multiple choice examination at the end of the semester. A total of two questions (Q6 and Q7) were used to assess SLO2. | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1. |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students = 57% correct = 99% |
|  | Shelby | # students = 54% correct = 95% |
|  | Clanton | # students = 17% correct = 82% |
|  | Pell City | # students = 18% correct = 75% |
| Spring 2017 | Jefferson | # students = 89% correct = 93% |
|  | Shelby | # students = 48% correct = 96% |
|  | Clanton | # students = 15% correct = 77% |
|  | Pell City | # students = 27% correct = 80% |
| Summer 2017 | Jefferson  | # students = 63% correct = 87% |
|  | Shelby  | # students = 36% correct = 83% |
|  | Clanton  | # students = 19% correct = 84% |
|  | Pell City  | # students = None% correct = |

**Total Students Tested = 443****Total Annual Success Rate = 90%** | The students tested met the requirement for success for SLO3 (90%).This is an improvement from previous years – 89% success rate, 2015-2016.Instructors will continue to emphasize content related to the infectious microorganisms during lecture and lab.  |
| 4. Students will be able to recognize proper laboratory technique and protocols including aseptic technique, media selection, slide preparation, and microscopy.  | Student learning outcomes were assessed by using a 13 question standardized multiple choice examination at the end of the semester. A total of 6 questions (Q8 – Q13) were used to assess SLO4 | 70% or > successful69% or < unsuccessfulThe percent is based upon the average of correctly answered questions related to SLO 1 |

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| --- | --- | --- |
| Fall 2016 | Jefferson | # students = 57% correct = 90% |
|  | Shelby | # students = 54% correct = 86% |
|  | Clanton | # students = 17% correct = 75% |
|  | Pell City | # students = 18% correct = 76% |
| Spring 2017 | Jefferson | # students = 89% correct = 93% |
|  | Shelby | # students = 48% correct = 83% |
|  | Clanton | # students = 15% correct =88% |
|  | Pell City | # students = 27% correct = 73% |
| Summer 2017 | Jefferson | # students = 63% correct = 83% |
|  | Shelby | # students = 36% correct = 83% |
|  | Clanton | # students = 19% correct = 79% |
|  | Pell City | # students = None% correct = |

**Total Students Tested = 443****Total Annual Success Rate = 85%** | The students tested met the requirement for success for SLO4 (85%). Though consistent with data from previous years – 85% successful 2015-2016, shows a slight increase. The use of laboratory exercises and lecture instruction is more than adequate for students to grasp the concepts of aseptic technique. Lab exercises will continue to emphasize the importance of asepsis and pure microbial growth. |
| **Plan submission date:** September 19, 2017 | **Submitted by: Stephanie Miller** |