Annual Report for Assessment of Outcomes

Submitted: June 15, 2011

SAC: Bioscience Technology (BIT)

Outcomes Assessed: Bioscience Technology AAS

1. Describe changes that have been implemented towards improving students' attainment of outcomes that resulted from outcome assessments carried out in the previous academic year.

   The 2010 Assessment of Critical Thinking focused on student laboratory notebooks with special emphasis on the analysis/conclusion section of each laboratory experiment. It was determined that students did not always take enough time to fully analyze their data and determine the experimental conclusions and appropriate next steps in their experiments.

   Several changes have taken place since this assessment was written but it is still an active area of assessment and still in need of improvement.

   - In order to more appropriately reflect how notebooks are used and managed in a real work environment, students are no longer allowed to remove their notebooks from the laboratory so they cannot write up conclusions outside of class. This has made it more difficult for students to have the time to fully process the information on experiments in the given laboratory time. To address this in the future, more class time will be set aside at the beginning and end of each class for students to analyze data and do the critical thinking required to draw conclusions from their data.

   - To help students with good documentation practices, students will be given examples of experimental documentation from previous student notebooks demonstrating the proper way to record raw data and draw conclusions from the data analysis.

2. Identify the outcomes assessed this year, and describe the methods used. What were the results of the assessment (i.e., what did you learn about how well students are meeting the outcomes)? Note: individual outcomes are described below with the method used (part a), and what was learned (part b).

3. Identify any changes that should, as a result of this assessment, be implemented towards improving students' attainment of outcomes. Note: individual outcomes are described below with changes that should be implemented as a result of each individual assessment (part c).

- Outcome 1: Apply knowledge of safety principles required to work in a bioscience laboratory or manufacturing environment.

a. *Method used*:

- 14 students (all students in the class) in the entry-level BIT certificate course BIT110 were given a multi-part safety-based scenario exam question after finishing the safety lectures and exercises in the class.

- The exam question was worth 10 points and was assessed using a rubric.

- The average score was 7.7

b. *Results: What did we learn?*

- Overall, students were able to adequately answer the safety scenario question, however there were parts of the question that more students had trouble with than expected. Students most often missed aspects of the question dealing with first examining the MSDS for a chemical and knowing how to dispose of it properly **before** beginning to work with any chemical.

c. *Changes to be implemented as a result of this assessment:*

- The BIT110 course is a class intended to cover a multitude of topics including several sessions on laboratory safety. In the future, more emphasis will be placed on proper use, handling, and disposal of laboratory chemicals during the safety lectures in this course.

- The BIT certificate program has a requirement for a safety course (BIT105) for students that do not take BIT110. In the future, we will use this same safety question to assess the level of preparedness of our students to work safely in a bioscience environment. We will also strive to make sure students are completely prepared to work safely in a laboratory environment as this is a fundamental skill and requirement of a properly trained bioscience laboratory technician.

- Outcome 2: Carry out routine laboratory tasks and commonly used techniques with confidence, quality and appropriate documentation in a bioscience environment.

  a. *Method used*:

     - 6 students (all of the students in the class) in BIT203 Recombinant DNA class were given a practical exam in which they were required to prepare a reagent (plasmid DNA) using a standard laboratory procedure. Students in this class are mid-way through the program so they have acquired a basic skill set and are refining their skills and techniques in this class.

     - Students were assessed on the quantity and quality of the reagent that they produced. Additionally, they were assessed on their documentation of their work procedure and results.

     - Student performance was evaluated by the instructor using a rubric assigning points for the quantity of the product, quality of the product, amount of time to produce the product, and accurate and thorough documentation of the procedure. The assessment was worth 100 points and the average was 89.1 for the 6 students assessed.

  b. *Results: What did we learn?*

     - Students were able to follow instructions and carry out a routine laboratory procedure in a given amount of time and produce a quality reagent along with the appropriate documentation of the experimental procedure.

  c. *Changes to be implemented as a result of this assessment:*

     - Based on observations and assessment during this practical exam, it became evident that one student did not possess the required skills expected of students in this course at this level. After this assessment, this particular student was given extra instruction and guidance in order to try to improve on deficits. This was actually quite crucial as it would not have been clear based on normal laboratory work that this student was not performing to the expected standards of the program. Following this assessment, practical exams have been integrated into many of the BIT courses in order to more closely monitor individual students and allow time for intervention and remediation when necessary. The plan is to continue using these practical skills assessments in BIT courses in the future.

- Outcome 3: Apply knowledge of measurement and assay principles and strategies, purification principles, and the scientific method to laboratory situations.

  a. *Method used*:

     - 6 students (all of the students in the class) in BIT215 Protein Purification class were given a practical exam in which they had to follow a written protocol to purify a protein using a technique that they had never done before. The purification procedure required students to apply the skills and knowledge learned about protein purification and assay techniques to a new situation. Students in this class are in the final courses in the program.

     - Students were assessed on their ability to follow instructions and accurately perform the appropriate assays and calculations required for the procedure. They were also assessed on the quality of their work as judged by the quantity and specific activity of their purified protein.

     - The assessment was evaluated by the instructor using a rubric assigning points for each item outlined above. The average was 190 points out of 250 with the high being 230 points and the low being 153 points. The average was lower than expected and therefore a great learning experience for the instructor.

  b. *Results: What did we learn?*

     - This assessment was very valuable because it highlighted which skills were acquired by all students and which were not. Students work in teams for many of the labs and individual assessment through practical exams allows a true assessment of what students are able to do on their own as compared to skills they can do as a pair where some of the tasks are done by each student. In addition, this assessment clearly pointed out that many students have a difficult time with assays while doing quite well on protein purification.

  c. *Changes to be implemented as a result of this assessment:*

     - Based on observations and assessment during this practical exam, the course will be taught differently in the future with much more emphasis placed on performing routine assays. This is a difficult thing for students to do and a very necessary skill for them to have. Additionally, students will be required to do assays individually in order to completely master the process. This assessment will be repeated in the future to see if the implemented changes help students master assay techniques.

- Outcome 4: Apply principles learned in courses to trouble shoot laboratory and manufacturing problems and devise and execute appropriate solutions.

  a. *Method used*:

     - 6 students (all students in the class) in the BIT215 Protein Purification class were given a multi-part scenario-based exam question at the end of the class (and the end of the program for most students). The exam question required students to outline a strategy to troubleshoot a problem in the research laboratory and contrast that with the manufacturing environment.

     - The exam question was used only for assessment and was not graded.

  b. *Results: What did we learn?*

     - Across the board the students were able to describe how to troubleshoot a problem in a research laboratory environment, but were not able to accurately devise solutions for troubleshooting in a manufacturing environment.

  c. *Changes to be implemented as a result of this assessment:*

     - Changes are being made to the course content for the BIT109 class in order to include more emphasis on working in a manufacturing environment. Additionally, a new course is being developed that will be required for students in the future. This new course will be a laboratory-based class that teaches students how to work in a regulated environment.

- Outcome 5: Plan and organize tasks to allow efficient completion of complex procedures, including planning and executing multiple procedures that proceed simultaneously. Coordinate with others to work as part of a team.

  a. *Method used*:

     - 6 students (all students in the class) in the BIT215 Protein Purification class were divided into teams of two students and given a task to work on as a team. The task was quite complex and required coordination of efforts by both team members as well as multitasking. For this assessment, students were given instruction manuals for several pieces of laboratory equipment that students hadn't used before and asked to set up a column chromatography system for protein purification.

     - Students were assessed by independent observation by two different instructors. The instructors evaluated the students on teamwork, multitasking, and on the ability of the students to complete the task in the allotted time.

b. *Results: What did we learn?*

- Students did a great job working with lab partners that they did not normally work with. They effectively coordinated work efforts and all students were actively engaged in the project. Students were very competent in their approach and execution of the task. While the students did a very good job overall, they were not able to multi-task as well as was expected under these conditions and had to be reminded many times about all the things that needed to be done simultaneously in order to finish the project on time.

c. *Changes to be implemented as a result of this assessment:*

- After this assessment was performed, it was clear that students were not as good at multitasking as expected. Because this is such an important skill for students to acquire, additional time was incorporated into subsequent laboratory exercises to incorporate techniques for multitasking. For one lab class, students were asked to organize and perform a series of tasks which when done individually would take 5-6 hours, but when done with adequate multi-tasking could be finished in the allotted lab time. Multitasking skills will be incorporated into many of the laboratory classes in the future so that students become familiar with how to multi-task and how to most effectively plan experiments and manage their time in the lab.

- <u>Core Outcome: Professional Competence and Communication</u>

  Please see BIT Program Outcome 2 (above) which maps to this core outcome.