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THE CRITICAL THINKING BIOLOGY FINAL

During my first five years of teaching Biology II for majors, I gave my students a typical multiple choice/matching/short essay comprehensive final exam. The subject matter of the course focused on biological organization from organisms to ecosystems. Each year my students would beg for a study guide or a chance to review old tests before the exam, and it became increasingly obvious that they were engaging in a form of study I called "bulimic biology." In this form of study, there was no critical thinking or application of knowledge to new circumstances, only prolonged gorging of the mind with disjointed biological facts that were later regurgitated on a test and promptly forgotten. Any relevance this material might have had to the everyday life of the student was lost in the purging stage, if not before.

In a lunch conversation with our reference librarian, I described my frustration with this method of evaluation, and she offered an idea for a possible solution. Her suggestion was a research project. At first, this seemed improbable as I did not see how I could evaluate students' knowledge over the entire semester in one project. However, I began to search for examples of other institutions engaging in similar forms of evaluation. I gained access to a wealth of materials from local, regional, and national honors organizations; here I found examples of many types of research projects requiring extensive critical thinking skills, as well as research and writing skills. I knew I was on the right track, but I would have to make some adaptations since my course was not an honors course.

The result was a research project that required individual students to reach back into each unit of the course and find information relevant to a current dilemma involving one organism. The first topic I chose was "Endangered Species," and each student was given an endangered species of Texas to research. I provided significant structure to the project by creating a rubric that outlined specific information required in the final report. This information included:

- taxonomy of the organism
- external morphology with visuals
- internal morphology with reference to specific organ systems studied
- reproductive strategy
- nutritional requirements and feeding behavior
- role in the food web
- predator/prey relationships and competitive relationships
- role in nutrient cycling
- special adaptations, making it unique and interesting
- reasons for its endangerment, and
- steps being taken to avoid extinction.

Students were required to submit a written paper with bibliography and present a ten-minute PowerPoint summary presentation in class. I was astounded by the effort students put into this type of final and even more surprised by the positive feedback. Most students welcomed the chance to do something research-oriented; and I discovered that although they had individual projects, students worked together to perfect their library research methods and PowerPoint skills. The top students even pinpointed relationships between assigned organisms and incorporated this information into their research and presentations, often asking to present in sequence in order to dove-tail their information.

One drawback to scheduling these presentations at the end of the semester is the temptation for some students to skip class when they are not presenting and study for other final exams. A grading grid ensured full participation by the class during presentations. Students were asked to rank each presenter's data for each of the assigned information categories. Ten points of the students' grades involved completion of the data sheet evaluating the entire class.

I also used a similar sheet to evaluate each student, with ten possible points in each of ten assigned categories of information. By making clear notes and assigning point values to each category, students could see

exactly how they were evaluated. This removed most of the subjectivity from grading.

Over the past five years, student grades on these presentations have followed a bell curve. Those with excellent study skills and motivation began research early and provided detailed information on their subject. Less academically inclined students often waited until the last minute; and while their PowerPoint presentations were often good, the written portion of the final was skeletal and incomplete. Each semester I have changed the topic to minimize borrowing information from previous finals. Topics have included keystone species, nuisance species, and exotic species.

Student feedback has been very positive, and many students have returned years later to tell me that they still vividly remember these projects. They often have expressed appreciation for the chance to do research and write in a biology course, and I have concluded that the use of different evaluation methods gives a more balanced picture of student ability. Multiple-choice exams may provide some insight into students' abilities, but the research project is a clear indicator of how well they understand the relationships between the different subjects covered during the semester.

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"TRANSFORMATIONAL" LEARNING USING SERVICE-BASED EDUCATION

A project that was started at Owens Community College with physical therapist assistant students makes learning fun and definitely provides a transformational learning experience for both students and instructor. In order to incorporate more sense of community service involvement with students, the physical therapist assistant program had three second-year PTA students participate in their first clinical experience at a local Muscular Dystrophy Association camp for a week.

Each student functioned as a "counselor" for a MDA camper and lived with the camper for an entire week. Although the students had no prior clinical experience in treating children with muscular dystrophy, they became proficient entry-level clinicians with their "patients" in the matter of six days. The students had to take care of every need of the camper—feeding, bathing, dressing, grooming, transfers, and all of their activities of daily living. They also had many activities that they participated in with their campers including swimming, arts and crafts, even a dance to end the week of activity. All three PTA students had campers who were significantly challenged both physically, from the effects of muscular dystrophy, and mentally, as well. All three students had made a "transformation" from a novice student PTA clinician at the start of camp to entry-level skills in gait and transfer training, range of motion, and therapeutic functional exercises at the end of the camp experience.

This alternative clinical education experience was an amazing educational event to witness, much like the noted educational psychologist John Dewey describes as transformational learning. The students, in the process of giving of themselves in this service-based learning exercise, received much more in an education that they will remember for the rest of their lives. Due to the unique setting, the students were able to integrate both physical and spiritual treatment because of their close and prolonged interaction together.

This MDA camp experience will become a permanent part of the OCC's clinical education curriculum. Educators and accreditation agencies for good reason encourage service-based learning—it makes good educational sense. Educators must teach more than techniques and theories; they must also teach the value of service and its impact on the field that they are teaching. All students commented, through their reflective journals, on the positive experience and the learning experiences that they gained during their week at camp. All clinical education experiences have the potential to be transformational learning; however, this service-based learning experience was the most powerful that this clinician/educator has seen in nearly 20 years in the physical therapy field.

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