Introduction

The theoretical content of a science course is intimately related to the skills and practices needed to form them. Most college introductory biology classes have an additional laboratory course (lab) that students are required to take to develop these skills and teach students to think like scientists. The purpose of the lab is to practice basic laboratory techniques, skills and practices needed to form them. Most college introductory biology laboratories, and those who could not. More research is needed to explore the reason for this gap and how to shift it in the direction of a category.

Methods

Analysis

All the labs on the introductory biology laboratory syllabus were included in this study, except for the first lab. Microscopic Life, in which I presented the study to the students and handed them the consent forms for students to sign. The purpose of the study was to assess how students were able to use the laboratory skills because they are simply “following cookbook protocols than thinking” (Stevens, 2008). The point raised is an important one—if labs are not effective, then why keep them around?

This question has motivated researchers in pedagogy and biology alike to try to measure student learning in the laboratory. A study headed by Elisa Stone (Stone, 2014) applied a different strategy of teaching, the Science Skills approach, to high school biology in the United States and Europe. This study was interested in observing and analyzing, and most of the responses needed fall under the category of “4” of the rubric, indicating the highest level of complexity in the response. However, the next most common response fell under the category of “2”, demonstrating a marked gap between students who could connect concepts learned in lecture to laboratory practices, and those who could not. More research is needed to explore the reason for this gap and how to shift it in the direction of a category.

Results

Table 2 (Left), A list of all the Science Skills students reported they used over the course of the semester. This list is ranked by frequency of mentions by students. Students could list two Science Skills used each week. This table shows the frequency of each skill used.

Table 2 (Bottom Left). A list of all the Science Skills students reported they used over the course of the semester. This list is ranked by frequency of mentions by students. Students could list two Science Skills used each week. This table shows the frequency of each skill used.

Figure 4 (Bottom Right). Results from the responses on the exit index cards were analyzed and categorized based on their level of complexity, following the criteria of the Science Skills Knowledge Integration (SSKI) rubric (see Figure 2). The caveat in this study was that the students did not turn in an exit index card. No rubric was used to assess whether the students understood the purpose of the lab.

Figure 6 (Bottom). Results from the responses on the exit index cards were analyzed for each specific lab. In general, students were able to understand the purpose of the lab (see Figure 4), except for the Plant Morphology lab.

Discussion

The primary purpose of this paper was to simply observe what skills students used in their labs, and how many times they used them, in an introductory college biology lab course. Results show that 70% of students knew the purpose of the lab as indicated by the learning outcome. However, this leaves 30% of the students who did not know the purpose of the lab. This result is obviously not ideal, especially since the students had a quiz at the beginning of each lab, so they should already read through the corresponding section in the lab manual to do well on the quiz. The Plant Morphology lab and the Fetal Pig lab were the two labs where there was a higher number of students who did not know the purpose of the lab. This suggests that there may be a need for pre-lab preparatory work, especially in these labs, so the students are aware of the learning objectives for that lab.

The results from the exit cards show that the most common Science Skills students utilized were Observing and Analyzing. These are two important skills needed to form the basis of scientific inquiry, and were appropriate given that a lot of the lab work was examining slides under a microscope and identifying structures on the tiled pig.

Across all labs, the students’ responses to the exit index cards most commonly scored “4”, meaning that they could explain a connection between the two Science Skills they listed. This signifies not only that most students could acquire and use basic laboratory skills, but they could also relate them back to the underlying concepts learned in lecture. One caveat is to be mentioned, and that is of metacognition. Metacognition is defined as “the awareness or analysis of one’s own thinking and behavior” (Tanner, 2012). While completing the exit index cards, students had the opportunity to reflect back on what they did in the lab, which they may not have otherwise done if not prompted. This metacognition could have led to a better understanding of how the skills they used in that lab is important to the study of the concept of the lab, and of science in general. This confounding variable could have been part of the reason why there were many students’ responses on the exit index cards, but certainly it is not a negative confounding variable if it promotes student learning. The next most commonly used Science Skills were “3”, signifying that some students just wrote two Science Skills without explaining why they used them. This could show that the students did not know how they used the Science Skills in the lab, but it could be also due to the students wanting to leave the lab early, since they can leave (individually) as soon as they have completed the lab.

References


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