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Closing the Loop: Using Assessment of Student Attitudes to Guide a Curriculum Change in an Allied Health Professions Microbiology Course

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Abstract

Background: Previously, a microbiology course for health professions majors included several inquiry-driven and work-intensive projects that concluded with students presenting each project as a PowerPoint presentation. In order to make the use of these active-learning exercises more amenable across academic terms, large-scale projects were replaced with small-scale homework assignments, each requiring only a 1 – 2 page essay. Student active-learning involved analyzing health data, using evidence-based medicine centered on a clinical question, shadowing a healthcare professional, and performing a community service, all done in the context of microbiology and/or public health. **Method:** Student attitudes regarding the various homework assignments were analyzed via survey. **Results:** Though the exercises had been downsized from full-fledge projects to homework assignments, students still rated all assignments as having roughly equal pedagogical value and relevance to course content. **Conclusion:** These assignments, designed to develop practical academic skills in students destined to become healthcare professionals, can be given during any semester including the shortened summer session, and they connect, as the projects they replaced, abstract course concepts to concrete applications in healthcare and public health.

Keywords: Active-learning; Microbiology education; Health professions education

Introduction

The importance of using active learning in undergraduate science education has now been firmly established [1,2], and science faculty have devised various pedagogies to incorporate more active learning into course curricula [3-7]. Undergraduate microbiology education has specifically benefited from this trend in active learning, with faculty devising new ways to engage students and encourage critical thinking in classes with high numbers of students interested in health care careers [8 – 15].

In a previous study [11], students in a health professions microbiology course were assigned four projects, each equivalent in size and scope to the traditional "scholastic paper" course project assigned in past years, and each involving elements of active learning and student engagement. Briefly, the projects were as follows: type 1(creating an informative brochure about an infectious disease), type 2 (shadowing a health-care professional), type 3 (performing a community service), and type 4 (conducting an original lab research study). Students were required to apply microbiology concepts to all four projects, and each project was submitted as a PowerPoint presentation. Results of an opinion survey given to students after completion of the final project demonstrated that while students had preferences for certain projects, students considered all four projects to have equal educational value and course relevance, strongly suggesting that all of them should be continued in future classes.

Unfortunately, the work was extremely time-consuming, strenuous, and even exhausting for some students. Furthermore, the summer session proved to be simply too short for students to complete all four projects. Thus, the problem was in continuing to use the active-learning elements most favored by students, but in formats that could be completed in any given semester regardless of semester length. The solution was to give students a choice of doing one of the projects, and to also assign several homework exercises meant to make up for projects the students didn't choose. I report here on a study of student attitudes regarding these homework assignments.

Methods

Students completed one project of their choice (from project types 1 – 4) and four homework assignments meant to provide much of the same active-learning that would have been provided by doing all four projects. The homework assignments involved considerably less work than the full-blown projects they replaced and are summarized in Table 1. For the health statistics assignment students compared national, state (Georgia) and county (student choice) morbidity rates of syphilis, gonorrhea or chlamydia using data from online government health records (from the CDC and from Georgia and county public health websites). For the

evidence-based medicine assignment students asked a clinical question, then answered it using information obtained from at least one journal article. For the virtual shadowing assignment students viewed several shadowing PowerPoint presentations made by students from previous classes stored in an online archive. For the service-learning assignment students wrote a short reflective essay about a volunteer activity. After the final assignment students completed a Likert-scale survey to assess their attitudes about the four assignments. Results were analyzed to detect any significant differences (ANOVA, 0.05 alpha level) in student attitudes about the four assignments.

Student Projects [11]	Homework Assignments	Summary of Homework Assignments
Creating a Brochure on an Infectious Disease ("Type 1")*	Health Statistics	Students would search government health databases regarding a selected sexually transmitted disease
	Evidence-Based Medicine	Students would pose a clinical question and search online for journal articles using PubMed and/or Google Scholars
Shadowing a Health Care Professional ("Type 2") [10]	Virtual Shadowing	Students would view shadowing presentations made by other students from an online archive and compare and contrast aseptic procedures discussed
Performing a Community Service ("Type 3")	Service-Learning	Students would perform a community service related to microbiology and write an experiential essay
Conducting an Original Lab Research Study ("Type 4")	Not done as a homework assignment	Students in groups of 3 – 4 would perform a lab research exercise as part of the lab course

*Currently, the Type 1 project no longer involves the student creating a brochure but now involves the student writing a formal literature review article directed at answering a selected clinical question.

Table 1: Comparison of Student Projects and Homework Assignments.

Results

Analysis of the student survey (Table 2, Figure 1) shows that there was only a slight difference in student responses to question 4 ($p = 0.04$) and no significant difference to question 6 ($p = 1$) indicating that students for the most part considered all four of the homework assignments to have equal "educational value" (question 4) and "relevance to course content" (question 6). In contrast, there were vast differences in student responses to the other survey questions. For example, service learning stood out as being the most "fun or enjoyable" and was given high marks for "personal value." Health statistics on the other hand was singled out as requiring the least amount of "work" or "time," and had the least personal value of the four assignments.

Discussion

In a previous study [11] students were assigned several active learning projects ("Types 1 – 4"), each requiring extensive work and culminating in a PowerPoint presentation. Even though students found the projects to have equal pedagogical value and relevance to course content, having students do all four turned out to be exceedingly burdensome for regular spring or fall session courses and completely unworkable for the truncated summer session course.

Question #	Survey Question	ANOVA (F-Test) p-values
1	Assignment was fun or enjoyable	<0.0001
2	Assignment required a lot of work	<0.0001
3	Assignment required a lot of time	<0.0001
4	Assignment had educational value	0.04
5	Assignment had personal value	<0.0001
6	Assignment was relevant to course	1

*With respect to survey questions 1 – 6 above, students were required to rank homework assignments on a 1 – 5 scale, where 1 is *strongly disagree*, 2 is *disagree*, 3 is *neither agree nor disagree*, 4 is *agree*, and 5 is *strongly agree*. F-test was performed on survey data to look for significant differences in student rankings of the homework assignments for each question (also see Figure 1).

Table 2: Student assessment of homework assignments: survey questions*

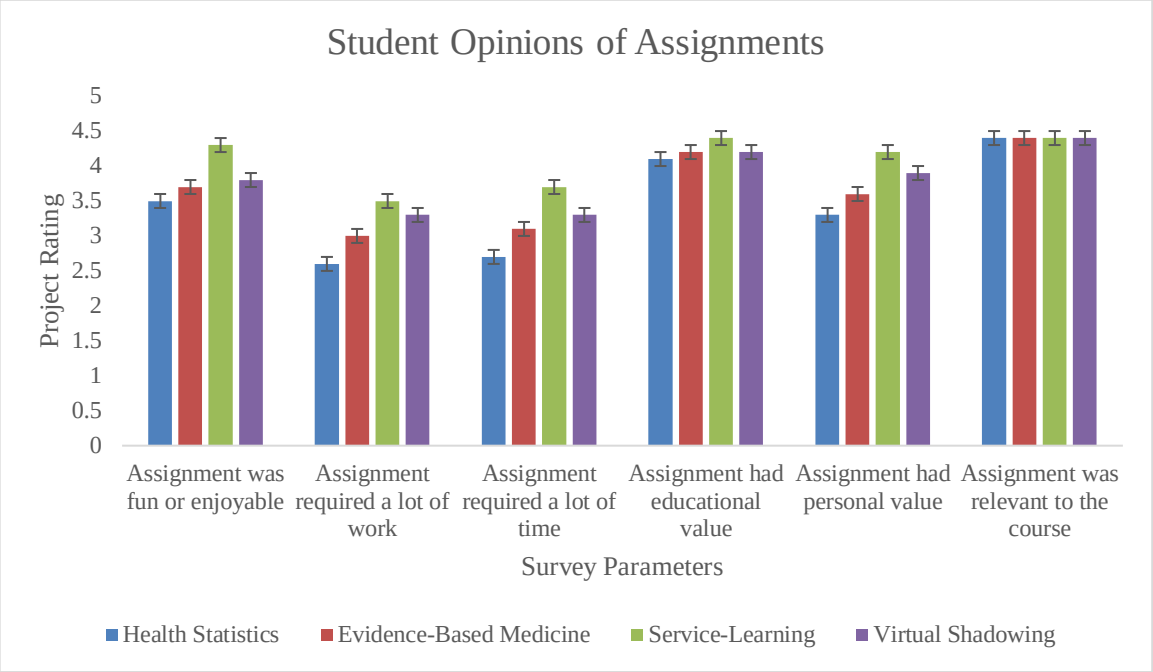

Figure 1: See Table 2 for details. Values indicated are means +/- standard error.

In the current study the projects were largely replaced with homework assignments (Table 1) requiring less time and effort and, more important, doable during the short summer session. Specifically, the Type 1 project was replaced with two assignments, health statistics and evidence-based medicine (EBM). The Type 2 project was replaced with a virtual shadowing assignment. The Type 3 project was replaced with a service-learning assignment. The Type 4 project was replaced (in a manner of speaking) with a research exercise that became integrated into the separate lab course. Despite the changes from full-scale projects to homework assignments, as in the previous study (when students evaluated all four projects), students in the current study had personal preferences for particular homework assignments but gave equal weight to all four assignments with regard to pedagogical value and relevance to course content. Furthermore, changing from projects to homework assignments had no impact on overall student performance; homework assignment mean scores did not vary significantly from project mean scores ($p = 0.2$).

Each of the homework assignments was chosen not only to replace a project but also to inculcate particular skills to students destined for careers in healthcare and/or public health. For example, the importance of health statistics training for students in medical professions has been established globally [16]. Similarly, evidence-based medicine has been increasingly taught to undergraduate medical students and its effectiveness evaluated [17,18]. The virtual shadowing assignment was chosen as a less time-consuming alternative to doing a full-fledge shadowing experience [10] but included elements of critical thinking, as students were required to compare aseptic procedures used in various healthcare settings. The service-learning assignment was likewise a less time-consuming alternative to doing a project (i.e., writing a 1–2 page essay rather than preparing a PowerPoint presentation), and the importance of service learning to student development has been well documented [4,6,12]. All four assignments required students to critically analyze data and/or information from journal articles or websites and to submit concise and clear prose compositions, also important skills [7,8,19]. There was no need for an assignment that would develop oral skills as such since all students were required to do, in addition to the homework assignments, a full-scale project with oral presentation at the end of the course anyway (they just didn't have to do four oral presentations!).

A limitation of this study is that specific learning gains were not assessed relative to course content, although it had been already established in the previous study [11] that doing the four projects had no significant impact (either negatively or positively) on overall course scores.

Conclusion

The favorable attitudes of students for doing several specific active learning exercises involving literature review, data analysis, shadowing professionals, and community service was not lost as pedagogy switched from using large-scale projects to using small-scale homework assignments. The use of homework assignments rather than multiple projects provides greater flexibility without sacrificing student enthusiasm and interest. It is a more sustainable practice throughout the academic year, and is adaptable for use in fully-online and hybrid modes of instruction

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