

Student Attitudes Regarding Active Learning In Health Professions Microbiology Course

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ABSTRACT

While many active learning strategies are evidence-based, it is unclear as to which methods are preferred by most students. In the present study students in an undergraduate health professions microbiology course were assigned four projects (“types” 1 – 4) that included elements of active learning and that required students to apply microbiological concepts to health care or public health. A type 1 project involved the student consulting professional journals, textbooks and/or websites and preparing an informative brochure on an infectious disease suitable for reading by the lay public. A type 2 project involved the student shadowing a health care professional. A type 3 project involved the student performing a community service. A type 4 project involved the student designing and conducting an original lab research study. A survey was used to assess student attitudes about doing these projects. I report that while some students preferred particular project types, no project type was preferred by a majority of students. In addition, students ranked all four project types highly and considered them all to have equal educational value and relevance to course content. These results suggest that instructors should avoid using a “one size fits all” active learning approach. Students value the use of diverse pedagogical approaches that engage their learning in different ways and that connect course concepts to real-world applications.

Keywords: Active Learning; Microbiology Education

INTRODUCTION

Active learning has become the predominant pedagogical philosophy in undergraduate science programs informed by evidence-based learning (Modell & Michael, 1993; Freeman et al., 2014). Faculty are now encouraged to supplement, if not replace, instructor-centered lecture formats (“passive learning”) with more student-centered pedagogies (“active learning”), which include problem-based or case-based learning (Smith et al., 2005), service-learning (Butin, 2010; Begley, 2013), inquiry-based learning (Luck, 2011), shadowing-based learning (Lowrey, 2016), as well as approaches involving students in critical analysis of scientific literature and in improving oral presentation and writing skills (Dorman et al., 2013). With so many learning approaches available to students, it may be time to ask the question: which learning mode(s) do students prefer?

A related concern is that some students have difficulty making connections between their coursework and their future profession. In an undergraduate microbiology course oriented towards health professions, I had initially for several years given a scholastic research project assignment in which the student would use library and internet resources to research a chosen infectious disease and prepare an informative brochure suitable for reading by the general public. Similar brochure writing assignments have been given by others (Dorman et al., 2013). I call this a “type 1” project. The main objective of this project was to move away from the traditional “term paper” assignment and towards something that would give students practice in applied-writing and explaining technical medical information to the lay public, all important skills for health professionals. More recently, though, I began to give students more options for their course projects, adding shadowing (Lowrey, 2016) as a “type 2” project, service-learning as a “type 3” project and lab research as a “type 4” project. Students could do only one type of project.

A preliminary unpublished study in which students evaluated their projects revealed that students considered their own particular project types to have high educational value. This naturally brought up the question: would students rate the other project types as highly if they had to do them as well? Addressing that question was the purpose of the current study. I report here that when given the opportunity to do all four projects, students may have preferences but still give all four project types equal pedagogical value.

METHODOLOGY

To encourage students to put abstract microbiological concepts into real (applied/multidisciplinary) contexts, each student was assigned four different projects (types 1-4). Each project was worth 10% of course grade. Students were given 3-4 weeks to complete each project. Projects were assigned in the following order: type 1 (compose a brochure on an infectious disease), type 2 (shadow a health care professional), type 3 (perform a community service), and type 4 (conduct an original lab research study). Each project had to incorporate microbiological themes (Lowrey, 2016). Following the end of the last project, students were given a survey to assess their opinions on various aspects of the projects. Results were analyzed by F-test to detect significant differences (0.05 alpha level) in student attitudes of the four projects. In addition, students were solicited to submit written comments on the survey form. Using grounded theory (Glaser & Strauss, 1967), as was done similarly (Begley, 2013), these comments were analyzed for key words and grouped into seven themes or *categories* and tabulated.

RESULTS

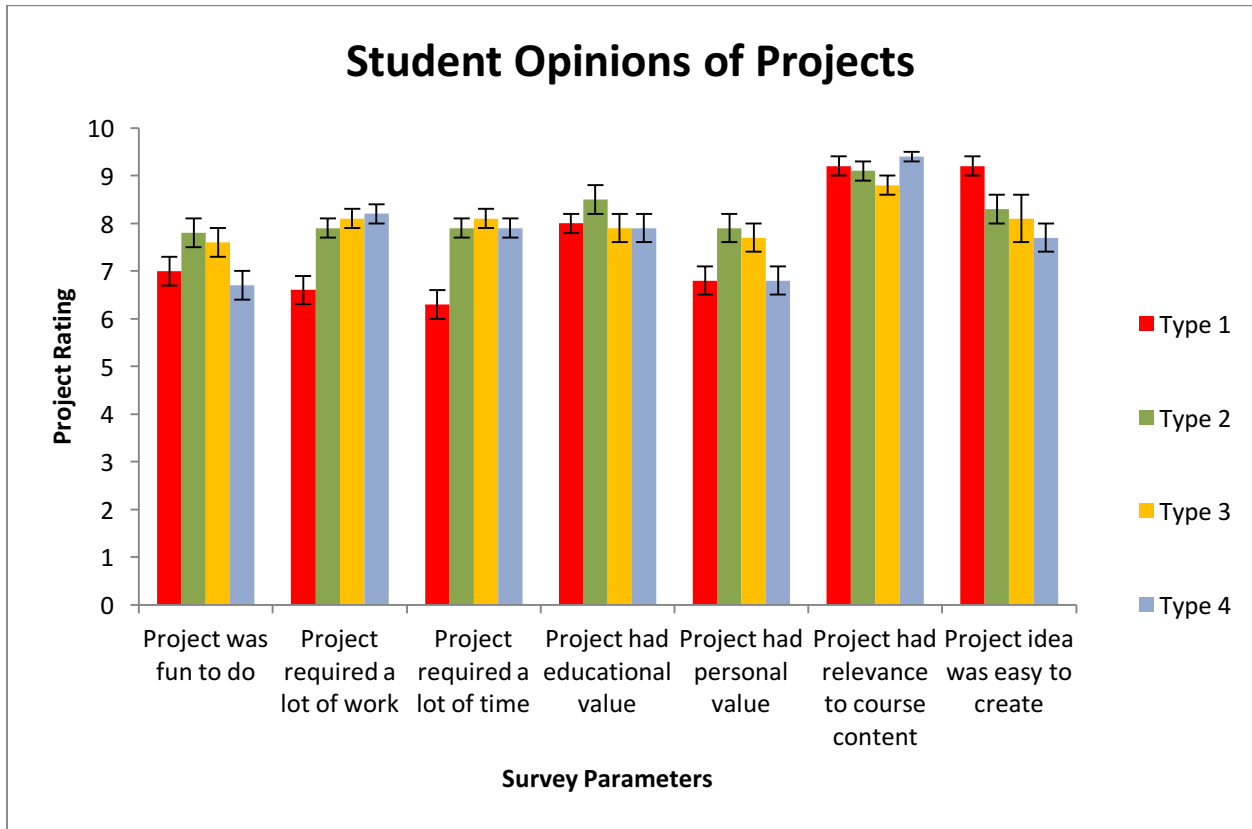
Analysis of survey data (Table 1, Fig. 1) shows that there were no significant differences (alpha level 0.05) in student responses to survey questions 4 & 6. Students considered all four of their projects to have equal “educational value” (question 4) and equal “relevance to course content” (question 6). In contrast, there were significant differences in student responses to the other survey questions. For example, students considered project types 2 & 3, rather than project types 1 & 4, to be more “fun” (question 1) and to have more “personal value” (question 5). Also, students considered project types 2 – 4, rather than project type 1, to “require” more “work” (question 2), to “require” more “time” (question 3), and to be less “easy” in finding an idea (question 7).

Table 1. Student Assessment of Project Types: Survey Questions*

Question #	Survey Question	ANOVA p-values
1	Project was fun to do	0.03
2	Project required a lot of work	<0.0001
3	Project required a lot of time	<0.0001
4	Project had educational value	0.3
5	Project had personal value	0.006
6	Project had relevance to course content	0.1
7	Project idea was easy to create	<0.0001

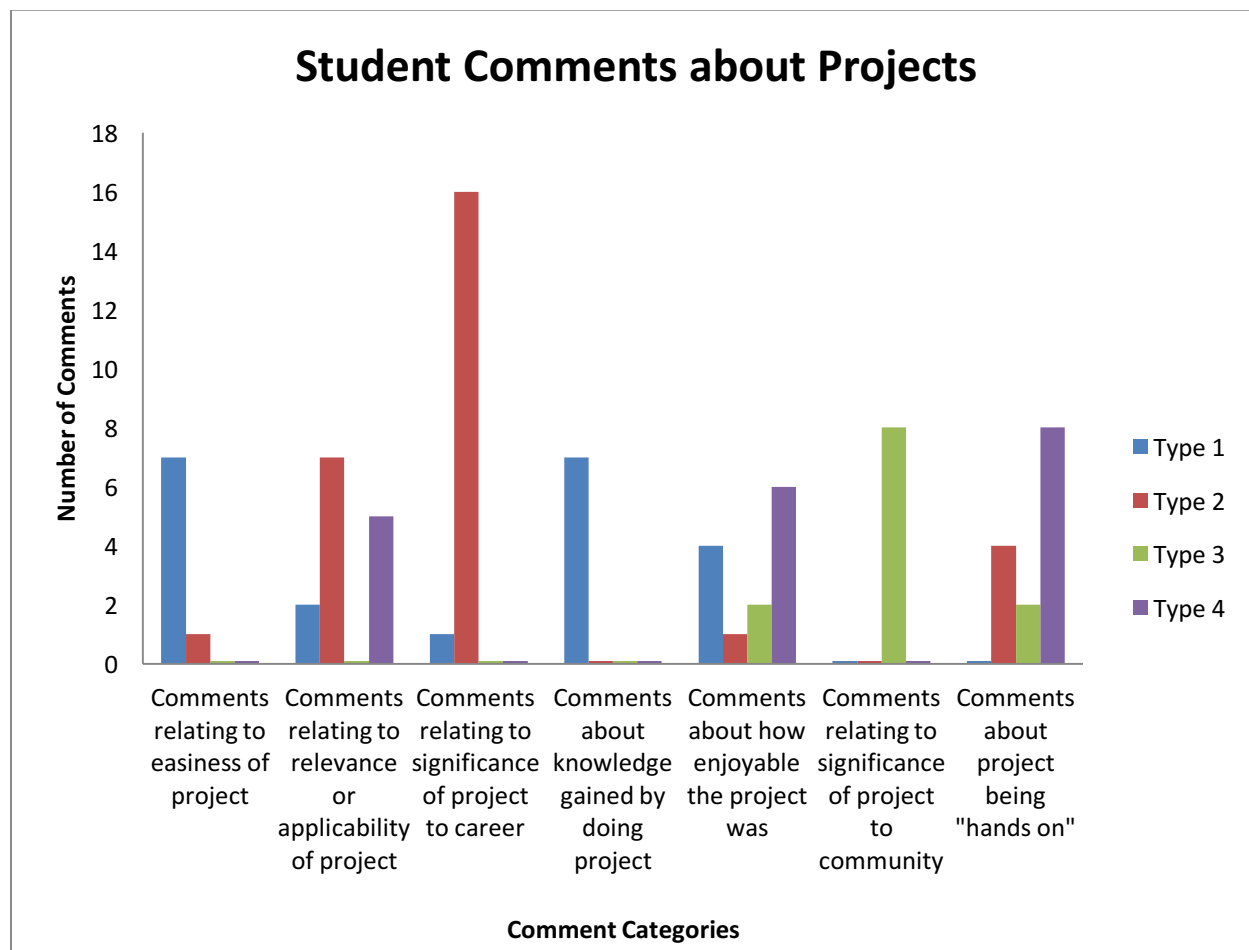
*With respect to survey questions 1 – 7 above, students (N = 74) were required to rank all four project types on a 1 – 10 scale, with 1 the lowest or weakest response and 10 the highest or strongest response. Analysis of variance (F-test) was performed on survey data to look for significant differences in student rankings of the four project types for each question (also see Fig 1).

Figure 1. See Table 1 for details. Type 1: creating a brochure, Type 2: shadowing, Type 3: community service, Type 4: lab research.



When asked on the survey form about their project preferences, 28% of students chose type 1, 30% chose type 2, 16% chose type 3, and 26% chose type 4. Students were also asked to give a reason for their preferences in the written comments section of the survey form. These student responses were then organized into 7 categories and tabulated (Fig. 2). Analysis of student comments reveals diverse motivations behind project preferences. For example, some students preferred the type 1 project because they considered it to be easier to do, learned a lot from doing it, and/or had fun doing it. Students preferring the type 2 project considered it to be more relevant to course content and career choices and was also more “hands on.” Students preferring the type 3 project were more interested in doing community service. Finally, students preferring the type 4 project considered it to be more relevant, fun and hands on.

Figure 2. Student written comments about their preferred project types were grouped according to key words or phrases into seven categories and tabulated. Type 1: creating a brochure, Type 2: shadowing, Type 3: community service, Type 4: lab research.



DISCUSSION

While it is generally accepted now that active learning is more effective pedagogy than passive learning, less is known about what learning approaches students prefer, especially in the sciences. In this study, where students completed four types of projects, where each project involved different elements of active learning, both semi-quantitative survey data and analysis of student comments suggest that the answer is “all of the above.”

Regarding the type 1 project (infectious disease brochure), many students indicated that they benefited from the self-directed and cooperative learning inherent in applied writing. A similar point was made in a study (Kommalage, 2012) regarding the values of essay writing by medical students. Furthermore, such writing helps develop communication skills in engaging with the lay public (Dorman et al., 2013). Similar brochure writing by students has been done also in the context of service-learning (Butin, 2010; Larios-Sanz et al., 2011). Regarding the type 2 project (shadowing), the practice of physician shadowing is certainly widespread, and studies have shown that shadowing programs generally increase the interest of students in medicine (Kitsis & Goldsammler, 2013). Nonetheless, little is known about the effectiveness of shadowing in undergraduate science education. In the present study students noted how the shadowing experience connected the course content to reality, as was also mentioned in another study involving shadowing (Lowrey, 2016). Regarding the type 3 project (community service), while students preferred project types 1, 2 & 4 over type 3 by roughly 2:1, those students that did prefer type 3 gave

comments about how it enabled them to do things that benefited the community, and valued it for that reason. A similar result occurred in other studies involving microbiology students engaged in service projects (Larios-Sanz et al., 2011; Cain, 2013). Finally, regarding the type 4 project (lab research), students considered it to be both “fun” and “hands on.” Indeed, inquiry-based undergraduate labs have become increasingly popular with both students interested in doing “real science” and with faculty interested in motivating students and helping them develop critical thinking, cooperative learning, and even oral and written communication skills (Luck, 2011).

Originally, I had planned this study in part to seek a single project type ranked highest for its educational value by a majority of students, and then to focus on that one project type (providing more time and resources to the students). The results of this study, however, indicate that while students may have their preferences for particular project types, no single project type is preferred by a majority of students. Furthermore, students consider all four project types to have equal educational value and relevance to course content. This evidence does not support the assigning of a particular project type exclusively or even the assigning of just a single project type. Similarly, Hoffman (2001) found success in using several active learning exercises in a microbiology course. On the basis of the current study it would be ideal for each student to do all four project types. However, this would be unsustainable as an on-going pedagogical practice due to time and resource constraints (especially during the summer semester). Future work in this regard will be to develop a series of smaller-scaled assignments (rather than the full-fledged projects discussed in this study) that nonetheless incorporates elements from all four project types.

In conclusion, when designing course curricula, faculty should consider that students have both diverse preferences and common interests regarding active learning approaches. Students appreciate receiving a variety of learning opportunities that further not only their academic development but also their personal and professional development.

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Dr. Lowrey is a Professor of Biology at University of North Georgia. He received a B.S. degree in Chemistry from Illinois State University, a M.S. degree in Chemistry from University of Illinois at Chicago, and a Doctorate in Philosophy degree in Biology from University of Illinois at Urbana-Champaign. His research interests include innovative teaching and learning assessment techniques and applied biology. Email: alex.lowrey@ung.edu

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