

Learning through Teaching: A Microbiology Service-Learning Experience [†]

Ginny Webb

Division of Natural Sciences and Engineering, University of South Carolina Upstate, Spartanburg, SC 29303

Service learning is defined as a strategy in which students apply what they have learned in the classroom to a community service project. Many educators would agree that students often learn best through teaching others. This premise was the motivation for a new service-learning project in which undergraduate microbiology students developed and taught hands-on microbiology lessons to local elementary school children. The lessons included teaching basic information about microbes, disease transmission, antibiotics, vaccines, and methods of disease prevention. This service-learning project benefitted the college students by enforcing their knowledge of microbiology and provided them an opportunity to reach out to children within their community. This project also benefitted the local schools by teaching the younger students about microbes, infections, and handwashing. In this paper, I discuss the development and implementation of this new microbiology service-learning project, as well as the observed impact it had on everyone involved.

INTRODUCTION

Service learning is an educational approach in which students apply the lessons and concepts learned in the classroom to volunteer within their community (4). One of the documented benefits of a service-learning approach is that students learn the importance of community service and volunteering. Research also suggests that students participating in service learning have an increase in moral reasoning (8). Other benefits recognized by students participating in service learning include improvement in academic achievement, social skills, and self-esteem (5). Because of these many benefits, service learning is being explored and encouraged on many college campuses as a useful educational strategy. Many colleges have begun to implement service learning into their curriculum, including their biology and microbiology curriculum. Some of these service-learning projects include volunteering at local clinics, creating educational materials, and partnering with local elementary, middle, or high schools to provide lessons or curriculum development (2, 3, 7).

This paper describes the development and implementation of a service-learning project involving undergraduate microbiology students. The project consisted of collegiate, undergraduate students developing and teaching lessons about microbes to elementary school children. Exposing elementary school age students to microbiology and proper handwashing

techniques can be critical in limiting the outbreak of infectious diseases (9). Regular handwashing can limit the spread of respiratory and gastrointestinal infections (1). Studies have shown that teaching students science using active learning or hands-on activities leads to an increase in academic achievement in science (6, 10). This project was developed as a way to involve undergraduate students in service learning while employing active-learning techniques to teach elementary students about microbes and the importance of handwashing. This project offered benefits for both groups of students. By participating in a service-learning project, the college students benefited by volunteering in their community, gaining exposure to possible career options, and learning more about microbiology. The elementary students benefited by learning about microbes and handwashing, gaining exposure to college students, and having an educational break from their daily routine. The project described here adds to the current literature by providing a detailed description of the development and implementation of a service-learning project that enables undergraduate students of any class standing or major to serve their community. This project also stands out as it was not a required part of a course curriculum; rather, students participated on a volunteer basis.

PROCEDURE

Lesson development

This project was developed by a group of undergraduate student volunteers who were part of a “Microbiology Interest Group.” The project’s aim was to develop lesson plans to help educate elementary school classes about microbes.

Corresponding author. Mailing address: University of South Carolina Upstate, 800 University Way, Spartanburg, SC 29303. Phone: 864-503-5976. E-mail: gwebb@uscupstate.edu.
[†]Supplemental materials available at <http://jmbe.asm.org>

Over the course of a semester, the group of students met every one to two weeks and worked on their lesson plans. To begin, the students made a list of important microbiology-related topics they wanted to cover in their lessons. PowerPoint slides were then developed giving information about these topics, and activities were planned to support each topic. A small group of two to four students worked on developing the PowerPoint presentation and activities in between the meetings of the larger group. The Glo-Germ activities were based on some of the undergraduate microbiology laboratory course work done by students. Other projects were developed by the students, often based on other existing activity ideas. The undergraduate students involved in the project included students majoring in nursing, biology, education, and accounting.

Lessons and activities

A PowerPoint presentation was developed that gave an overview of microbes, infections, antibiotics, the immune system, and vaccines. Several versions of the PowerPoint were developed so that the presentation could be tailored to the age and grade of the children who would be participating.

The second part of the presentation included hands-on activities aimed at demonstrating the concepts discussed in the PowerPoint. Several of these activities utilized Glo-Germ, a lotion that glows under UV light, to demonstrate their point. Students would use the lotion to observe how germs spread when shaking hands, as well as to evaluate their handwashing techniques. Other activities that were developed included using colored water to evaluate the distance sneeze droplets travel and the best way to cover a sneeze, using plastic craft beads to model disease transmission, and an antibiotic activity that demonstrated what happens when a patient does not take the entire course of antibiotics they were prescribed. Details of the Glo-Germ and sneezing activities are included in Appendix I.

Delivery of lessons

Once the lessons were prepared, the college students presented the lessons to individual classes at a local elementary school. The group presented to one grade level each time they visited and did separate presentations for each of the four or five classes in a given grade level. Three to five college students participated in each day of lessons. Following the elementary school visits, an anonymous survey was given to the elementary teachers and the college students to assess the impact of the project. The survey was delivered to teachers and college students online using Survey Monkey (surveymonkey.com).

Safety

There were no safety issues related to this activity. All activities were simulations using manipulatives that pose no

safety risks. The Institutional Review Board reviewed this project and determined it was not human subjects research.

CONCLUSION

Impact on elementary students

Based on the elementary school teachers' survey responses shown in Figure 1, the service-learning project had a positive impact on their students. All teachers (n=13) agreed that the college students were well prepared and their lessons were well presented. The teachers also all strongly agreed that their students enjoyed the lessons, learned more about microbes, and benefited from the visit from college students. All teachers would invite the group back to their classroom and agreed that the microbiology lessons taught were successful and impactful for the elementary students. Using the hands-on activities created an exciting learning atmosphere, as the students were active and responsive to each activity. Table 1 presents written comments provided by teachers in the survey. These supportive and praising comments provide evidence of the impact and success of the lessons.

Impact on college students

The impact of this service-learning project was not limited to the elementary students. The college students participating in this project also benefited as evidenced by the survey results in Figure 2. All students (n=6) strongly agreed that this project was an enjoyable and valuable experience. More than half of the students surveyed even agreed that the project made them consider a career in microbiology or teaching. Students all agreed that the project helped them realize the importance of volunteering, which is something they plan to continue. They also all agreed that developing and teaching these lessons helped them learn more about microbiology while developing public speaking and teamwork skills. The college participants enjoyed this project. Table 2 shows written comments they provided on the survey.

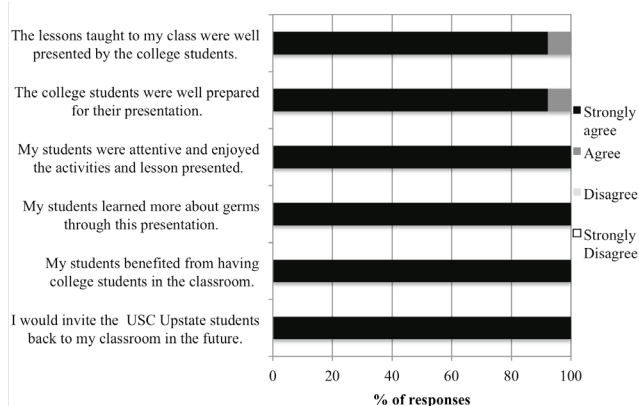


FIGURE 1. Results of survey given to elementary teachers after microbiology lessons were presented to their class (n=13).

TABLE 1.

Teacher comments from survey following lessons presented to their class.

1. My kids loved it! They now believe what I say about spreading germs!! Thanks so much for sharing with our school!
2. Very grade-level appropriate. Thank you.
3. I absolutely loved this visit! Your students were so kind and interactive with my students. They used appropriate language that the kids could understand and kept their attention at 1:45 on a Friday. That is nearly IMPOSSIBLE to do with first graders! :) The students had great demonstrations that allowed student participation and allowed them to share their thoughts and ideas. I thought that your students were well prepared and we would love to have them back again. Thanks so much!
4. It was AWESOME! My class talked about it for the rest of the afternoon! The presenter was very prepared and there was no 'dead' time to allow the students to have disruptions. Excellent job!!
5. Great energy and enthusiasm; very knowledgeable :)
6. My students genuinely enjoyed the presentation and could not stop talking about it after you all left. Thank you for coming in!
7. Great activities! We learned some valuable information. Thanks for coming.
8. The presentation was great. The students were engaged and excited.
9. Well organized, well prepared, thoroughly enjoyed by my students... thank you!
10. LOVED the handshake activity and the germ light – the kids were captivated! Hope to have you all back next year.

TABLE 2.

College student comments from survey following elementary school lessons.

1. Would love to do it again! It was so much fun!
2. I had a great time. It is always rewarding when you see kids soaking up what you just taught them.

loved having visitors to their classrooms and were very excited about the hands-on activities. They were very interactive and learned a lot from the lessons. Providing hands-on activities about handwashing and how microbes are spread will hopefully help the students practice good hygiene and lessen the spread of infections in their school. The project also benefited the college students by giving them exposure to different possible career paths and by giving them an opportunity to volunteer in their community. Overall, this was a very enjoyable, successful, and impactful project.

SUPPLEMENTAL MATERIALS

Appendix I: Activities

ACKNOWLEDGMENTS

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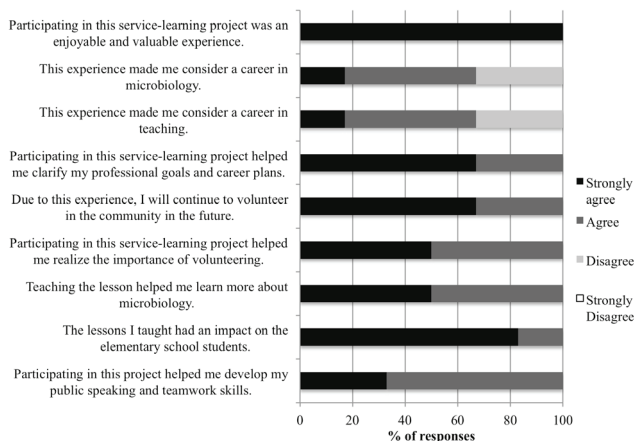


FIGURE 2. Results of survey given to college students after participation in elementary school lessons (n=6).

Final conclusions

In summary, the implementation of this service-learning project had a positive impact on elementary school students as well as college students. The elementary school students

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