foundry10

Robotics Fall 2016

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Introduction

Pre and Post survey data was collected from two schools with the goal of improving our programs and the experiences that students have within them. By collaborating with the students to create projects of their own interest, we believed that they would be more confident in their outlook of their learning and future technological challenges. Our findings show that this is in fact the case. Students that participated in this program showed an increase in confidence in technical skills that we covered as well as an increased feeling of understanding the field of technology in general. We also discuss our future research directions.

Program Description

During the Fall of 2016, foundry10 offered a Student-Led Robotics class to two local schools. One class was held in a private girls' middle school, Seattle Girls' School (SGS), and the other was held in a public mixed-gender high school, Big Picture School Highline (BPS). The program is titled "Student-Led Robotics" and is described in detail here: http://foundry10.org/wp-content/uploads/2016/07/Student-Led-Robotics.pdf. In both programs, students were tasked to come up with a project of their own interest and then present their work to the class at the end of the quarter.

On the first day of the program, we introduced the expectations for the class and had the students complete a pre-class survey to both gauge their interests and analyze the impact of the program after it had ended with a post-class survey. The structure of the class allows students to choose the project they work on and get guidance from their instructor.

Before they begin, all students get an opportunity to learn how to solder as this is a fundamental skill for roboticists and tinkerers. We utilized the comic "Soldering is Easy" (https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf) in hopes to show students that they should not be afraid to fail as they approach technological challenges.

On the second to last day, the students completed a post survey so that we can see how their feelings towards technology and robotics changed. On the last day of the class, students present their work to their peers to get feedback and talk about their future directions.

In this paper, we look at a comparison for the pre and post results for those two classes. Students were asked to assess their own skills and opinions. At the beginning and at the end of the program, students were asked to respond to the following Likert-type questions:

- I plan to have a future career in a technology related field.
- I feel confident when faced with technological issues.
- I am interested in technology.
- I feel that I understand the field of technology.
- I have experience with robotics.
- Robotics is a communal-social experience.
- I am confident in my ability to solder.
- I know how to look for problems in my wired and soldered connections.
- I plan to work with others during the Elective, I felt comfortable working with others and asking for help.
- I am not afraid to fail. In fact, I think failure is part of the process and is a good thing.

They were also asked open-ended questions:

- What branch of robotics do you find most interesting?
- How do you stay up to date with technology news (Read news sources? Watch YouTube channels? etc.)?
- Do you have any role models? If so, who?
- Have you ever built something? If so, what was it?
- What inspired you to you join the Robotics Elective?
- What are you looking forward to doing in the Robotics Elective? What do you want to learn?
- What does success look like in robotics? What does it mean to be successful in robotics?

Results

	Gender	
	Male	Female
Middle School	-	9
High School	7	1

There were differences between the two classes in career plans. Seventy-five percent of the high school class agreed or strongly agreed with the sentence, “I plan to have a future career in a technology related field”, compared to only 22% of the middle school class at the start of the session. Correspondingly, there were persistent differences between the two classes in confidence with technology. However, in both classes the majority of students showed an interest in technology.

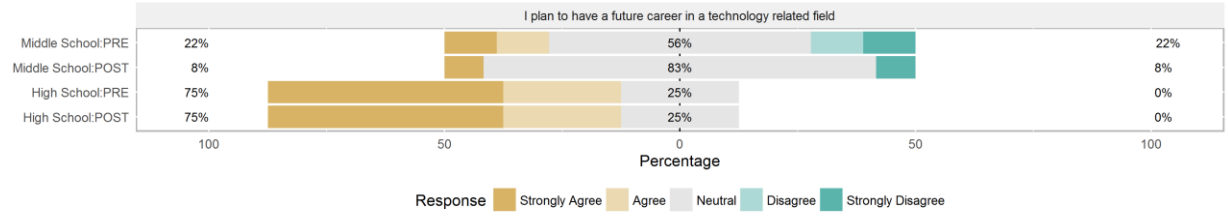

Figure 1

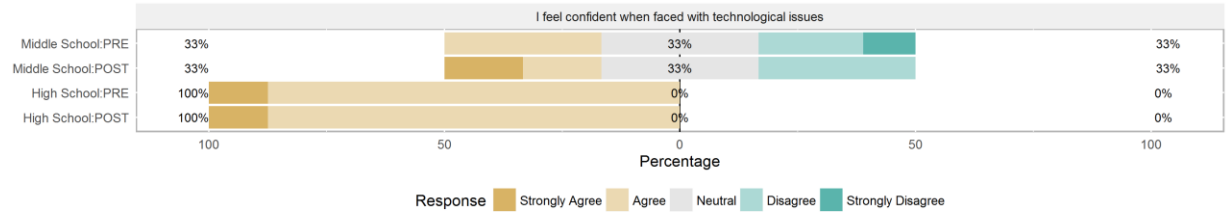

Figure 2

These differences were to be expected as SGS encourages students to try things outside of their comfort zone by placing them in electives under a subject area that they have not yet experienced. On the other hand, BPS students can select the elective they sign up for and are able to repeat the same elective until graduation. Looking at the above figures, we can see the result of that selection process as SGS has a relatively standard distribution of students (Figure 1 and 2) and BPS has nearly all students coming into the class with an interest in technology related careers and confidence when faced with technological issues.

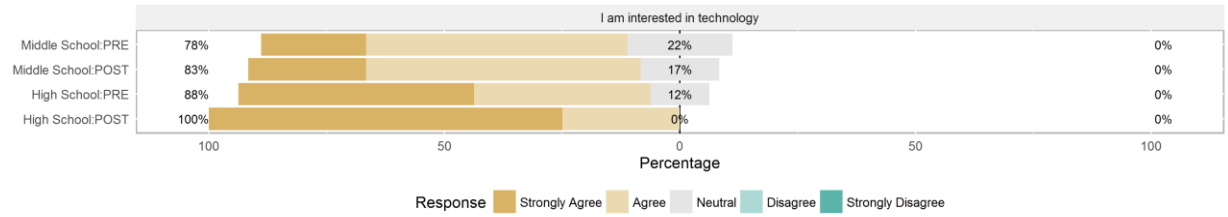

Figure 3

There was a slight increase of interest in technology in general for both SGS and BPS. This suggests that exposure to technology and the approachable nature of the class was successful in improving student attitudes towards technology. Although we did not observe it here, it is possible that exposure may create adverse feelings towards technology if they had a negative experience. As such, we believe that the focus for program designers should be on the overall experience rather than the specific technology used.

In both classes, we observed improvement in skills and knowledge related to robotics.

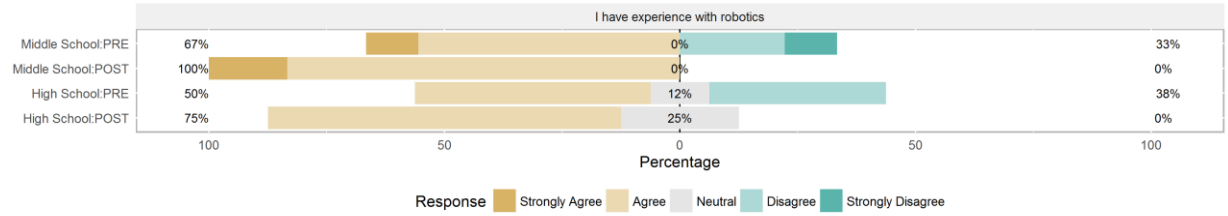

Figure 4

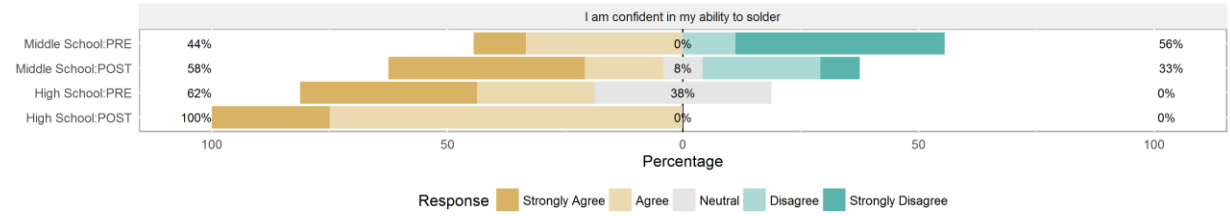

Figure 5

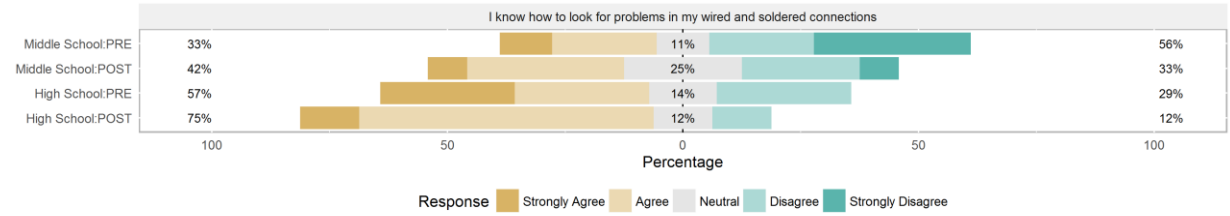

Figure 6

As a whole, the class appeared to contribute to improvements in students' understanding of technology. The above data seem to indicate that upon gaining experience with robotics and these technical skills, students are more confident in their ability to approach robotics and technical challenges.

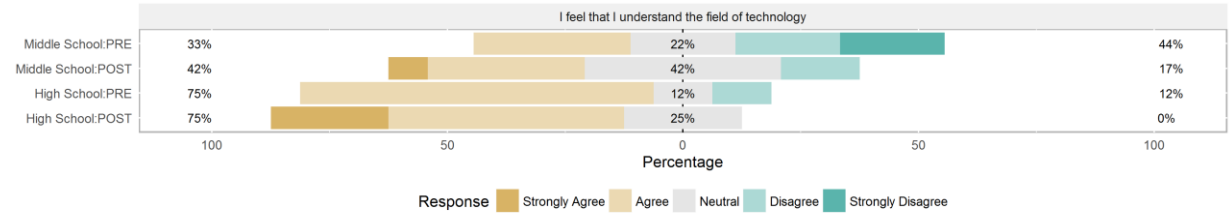

Figure 7

One of the goals for the class was for the students to be more comfortable with trying things out in the face of possible failure. We believe that by utilizing the "Soldering is Easy" comic and repeatedly expressing that "it's easy to fix a mistake", the students learned that they should not be afraid to try and potentially fail. Students in the two classes tended to rate themselves as not afraid to fail at the beginning of the class. However, 3 students (33%) from the middle school class changed their answer from "Agree" to "Strongly Agree" over the course of the class.

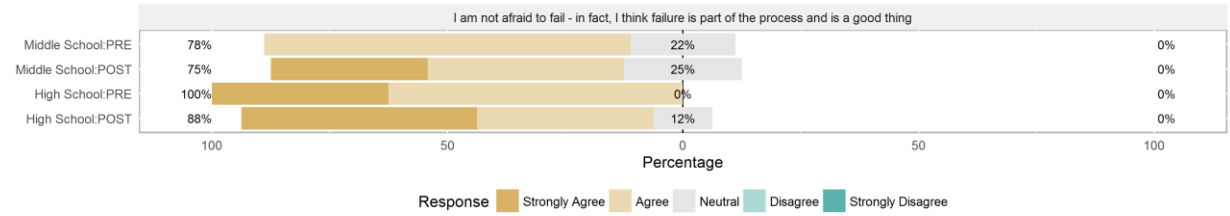

Figure 8

Future Directions

For future sessions of the class, we are hoping to define what 'student-led' means for a foundry10 robotics program. To do that, we want to be able to answer two questions. The first is: how do we best implement a student-led robotics class? Our second question is: what do robotics students get out of a student-led class?

As shown in the data above, we have been able to teach the class to students with a wide range of interest and experience in robotics, and students develop better knowledge and understanding of technology from their experiences in the class. However, it can be hard to look at all the students who participate in our robotics class in aggregate, since there are large individual differences in students' interests and plans, and often large differences between the schools that host the class. In future classes, we're hoping to get a better idea of what the different goals and attitudes of students are.

Besides those two main questions, we would like to further refine our questions so that we can get more detailed information about the students' outlook on technology and their confidence in facing tech. Specifically, it would be interesting to see how students respond to questions asking them about their outlook on learning new technical skills or their confidence to take on new technological challenges. How does their outlook change after learning a new technical skill? Will students be more inclined to take on new challenges, if they had a positive experience in this class? When it comes to introducing students to technology, we believe that program design is of the utmost importance and that the curriculum does not necessarily revolve around the hardware and software. We are constantly working with students in various robotics classes and hope to further support them in their self-guided discovery of robotics.