



Effective Teaching Methods

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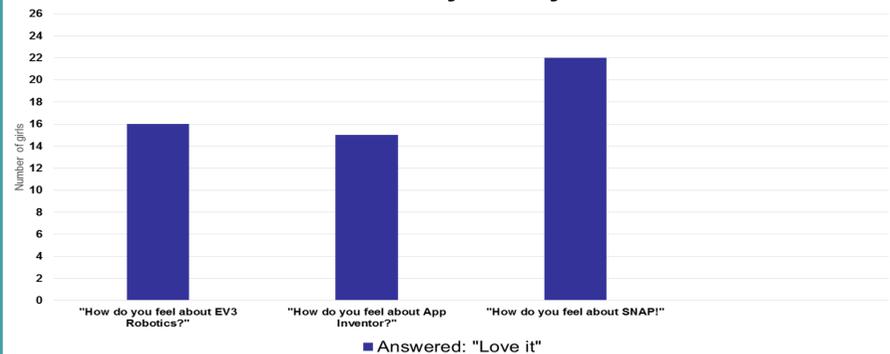
Abstract

The number of women in computing and other technological fields is exceedingly low, leaving females in computer science a definite minority. This has led me to a research process of finding the most effective method to grasp the attention of young students and help them become interested in computer science fields. The main focus of this experiment is to help boost the confidence of young girls and other minorities and to recruit them successfully. I, along with another colleague, conducted research to decipher whether middle school students from grades 6th-8th prefer drag-and-drop coding versus a more hands-on approach with EV3 Robotics. This data will help in determining a useful recruiting tool to interest middle school aged children (especially female) into computing and eventually into computer science related degree programs. For research, I taught a drag-and-drop coding program called SNAP! and EV3 Robotics at an all-girls summer camp. After each day, the girls would answer a multiple questioned survey about what camp activities they enjoyed the most or which lessons they understood the most. Also, before the camp, the students were required to answer a survey about their knowledge of computer science terms and ideas. They began camp with very minimal confidence, knowledge, and understanding of these ideas about technology. After the camp, the students took one last survey, and this proved that the girls were much more intrigued by the hands-on activities. They also were able to identify a significantly larger amount of computer science terms. The surveys proved that many girls who enjoyed the Robotics and SNAP! activities, were also interested in pursuing a future career in a computer science field. With the data from the surveys, my colleagues and I are determined to include more hands-on activities that promote computer science and other technological fields and use the most effective methods in future lesson plans.

Introduction

The amount of women in computing fields is extremely low. According to Erik Sherman, "In 2013, only 26% of computing professionals were female. Our research goals are to significantly increase the percentage of women in computing and technological fields. This includes discovering methods of recruiting to spark interest in middle school girls, ultimately teaching them about computer science enjoy computer. Also, we aim to help boost their confidence and help girls realize they are capable of creating and adapting technology. . Both results were very pleasing as the percentages were higher than expected. Our hypothesis is that girls from 6th-8th grade will be intrigued by hands-on activities such as robotics or drag-and-drop coding. At first, I hypothesized that the robotics and hands-on activities would be the most popular and effective versus the drag-and-drop coding. We also hypothesized that about 30% of the girls would "love" the SNAP! Program.

Individual Activity Survey Results



Results

Our research and experiment agreed with my hypothesis and also provided additional data that was not initially accounted for. Statistically, the girls enjoyed the SNAP! activity more than the EV3 Robotics activity. I earlier predicted that robotics would be more popular but the students favored a more code-based program. In the graph above, it shows that 71% of the girls said they "love" SNAP! And a few less (51.5%) claimed that they loved EV3 Robotics. The App Inventor results showed that 48.5% of girls said they "loved" the activity. The results from the pre camp survey and post camp survey are shown in the graph to the top right. This data shows an increase of understanding after the camp versus before the camp had started.

Background

At New Mexico State University, we are Undergraduate Research Assistants for a program named Young Women in Computing (YWiC). Within YWiC, us and other colleagues attend outreaches for STEM recruiting and give information to elementary through high school students about technological fields. We also prepare lesson plans and introduce Computer Science to groups of students throughout the year. Most of our research is concentrated on the minority of women and certain ethnic groups in computing. There has been a significant decline in the amount of women in computing fields. According to Erik Sherman, "Part of this decline is due to the fact that computer science became a male-identified field." Our goals include recruiting more women into STEM fields and we conduct an all girls' summer camp to achieve these goals. We plan to boost the confidence of young girls to give them an early mindset of what they are capable of. Our research includes using many types of teaching methods and approach methods to find the most effective in doing so.

Acknowledgements

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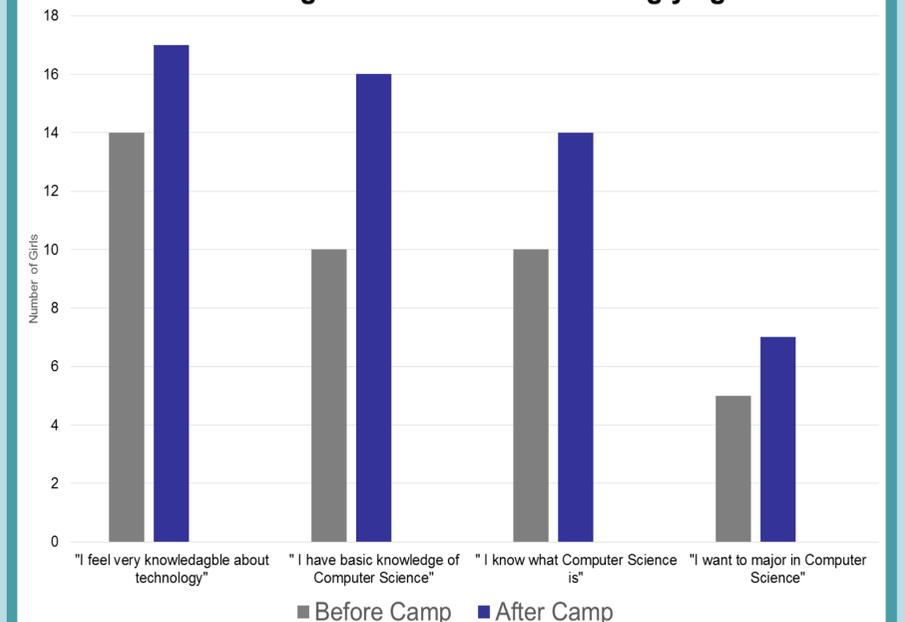
Method of Approach

Our method of approach to this problem was researching many computer-science-based kids' activities. At NMSU, Young Women in Computing conducts and all-girls summer camp. This is where we executed the experiment. We found a program called SNAP! which is a drag-and-drop coding activity. SNAP! includes many buttons that have small lines of premade code. The students drag them into the user interface and put them together to make a character move a certain way. This is a very beginning level of programming, as SNAP! includes a list of instructions for a computer or character to perform. We also developed lesson plans for EV3 robotics. EV3 Robotics consists of hardware and software design. The students built robots of their choosing out of Legos, and then programed a 'brain' or a brick to move those parts in a certain way. My colleague also prepared an activity in a program called App Inventor. Here, the students program small sections of code and assemble them to create an App. During the summer camp, the girls answered many surveys. They answered a pre camp and post camp survey, including a survey at the end of each session (day). The survey included the following questions:

- "I feel very knowledgeable about technology"
- "I have basic knowledge of Computer Science"
- "I know what Computer Science is"
- "I want to major in Computer Science"

These questions were asked on the first and last day of the camp. The answer options were "Strongly disagree (1) to "Strongly agree" (5). The purpose of the questionnaire was to see that the lesson plans and teaching were effective in improving the girls' knowledge of Computer Science. We also asked questions after each day of how the girls felt about each activity we did.

Number of girls that answered "strongly agree"



Conclusion

Both results were very satisfying as the percentages were higher than expected. Despite our hypothesis, the students enjoyed SNAP! the most. We earlier predicted that the EV3 Robotics would be most popular due to the amount of hands-on time it required. To our surprise, the girls enjoyed making their own programs in SNAP! and learning small lines of code. Also, the amount of girls who answered "Strongly agree" to having knowledge of Computer Science increased. The girls enjoyed the SNAP! programming more than the other activities but all of them were successful in the experiment. This means that the programs and lesson plans that were executed were successful in teaching young women about computer science.

Future Work

In the future we plan to continue this research and search for other effective activities to recruit young women into computing fields. We also plan to include our current unfinished research on high school students. Our overall goal is to include different types of activities and curriculum targeted to different age groups that will be the most successful recruiting tool in each of them. We also intend on including different question types in future surveys to understand the different outlooks that girls have on Computer Science and other technological fields.

References

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