Middle School Students Attitudes about Mathematics when using Inquiry Based Software to Guide Mathematic Content

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Introduction

Abstract

Using modern educational software boosts student engagement and provides a setting where students are reinvigorated about learning material (Kosa, 2009). In programs like Scratch, students are able to create and test boundaries/limitations of geometric concepts by testing conjectures and verifying ideas. Teaching with Scratch in the North Florida Freedom Schools, I examined math attitudes with a middle-school population using surveys, interviews, and informal observations of students. I was able to do this using an intervention in which students' were given specific math challenges and engaged in open dialogue while interacting with the software. Survey questions were derived from a modified Mathematics Teaching and Technology Attitudes Scale (MTAS) survey, adding specific questions about Scratch software. Post interviews were conducted with a subset of students. Results showed that students' overall attitudes about math made a positive change during the course of the 6-week program. Although there was differences in engagement observed between boys and girls, interviews with both groups corroborated the survey results.

Aims of the Research

Aims of this Research are to understand the following:

- How students' attitudes about mathematics may be influenced after using the Scratch in a summer math class
- Overall attitudes about math using computer interactive software to teach a geometric skill as an intervention compared to using the same skills in a traditional lecture/notes style classroom
- How a technology intervention that might engage students and allow for a deeper exploration of math practices

Research Questions

How might using a coding program that incorporates Transformation Geometry in coding block format, positively influence students' attitudes about math?

What elements of Scratch are students finding engaging that can lead to a change in attitudes about Mathematics?

Method

Research Design

This was a mixed-methods design where all enrolled middle-school students meet with myself as the instructor twice a week for the duration of an hour in which students were given a math task and an assigned project using Scratch. Some sessions involved mixed groups while others were conducted separated by gender based on camp activities. Each day was structured similarly: Students came into class and were given a math challenge for the day and approximately 20 minutes to complete it through coding. Once all students completed the challenge, there was time to work on an individual project. Over the 6 weeks, students completed 3 projects at their leisure while I made informal observations about their learning process. A change in curriculum needed to be made as I anecdotally observed girls not interacting with the software as much during Week 3. Surveys were administered and interviews with students were conducted at the end of the term.

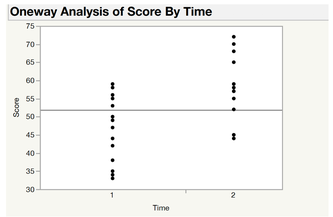
Participants

Participants were enrolled in one North Florida Freedom Schools' summer camp. There were 22 students who participated in the Scratch activities. Of those, 21 surveys completed pre intervention surveys and 15 completed completed post intervention surveys were collected at week 6. A total of 8 students (4 boys and 4 girls) participated in interviews.

Data Collection and Analysis

Quantitative data were gathered through a survey adapted from M.T.A.S. where students answered Likert-Scale questions about their attitudes about mathematics. Students took this survey pre and post the 6 week camp. Pre and post survey scores were totaled and independent samples t-test was used to see if there was a change in overall math attitudes. Data for each test was analyzed using an independent 2 tailed t test. Interviews were analyzed through open coding, fine tuning codes and identifying relationships in themes. Two common themes that emerged were negative feelings about "traditional math" and "workload" associated it.

Pre and Post Total Scores



Results

Conclusion

Preliminary results indicated positive changes in math attitudes after the use of Scratch as an intervention. M.T.A.S. results illustrate that, on average, students' attitudes about math did improve throughout the course of the 6 week period. Survey results showed statistically significant difference from pre and post tests with a p value of .00014 (two-tailed test) at the 95% confidence interval. The change from pre-test M=47.7 to post tests M= 58.2 with an effect size of 10.54. During interviews, students' commented on enjoying the teaching style over summer. The girls were observed to not be as engaged with the software as the boy during the first two and a half weeks; however, post-interviews revealed similar answers about liking the program and identifying the transformation geometric concepts embedded in the software. All students reported identifying the math in Scratch and liking the use of it to explore math concepts.

Discussion

The use of Scratch as an intervention included using the software as a guide to pedagogy that included providing specific math tasks, assigning projects, leading discussions and interacting with students. Survey results indicate there was a significant positive change in students' math attitudes. Although there were anecdotally observed differences in boys and girls working with the software, interview responses were similar: students were able to identify the mathematics within the software and were reportedly more engaged using the coding program than in a traditional math class. The modification included scaffolding projects and projecting which coding blocks to use during this time. If I were able to re-design this research, I would add an additional interview for girls about why they felt less engaged. Additionally, I would ask all students to keep a journal documenting their experience at the end of each session to gain a better understanding of their learning process. Further research to explore about the differentiation in learning patterns between middle-school boys and girls while using a coding program.

Key References

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PURPOSE
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