

TJHSST Computer Systems Lab Senior
Research Project Paper
Elementary Education in a Technology Age
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Abstract

Technology becomes more advanced and more accessible with every passing day. Education should be utilizing this technology boom in teaching current students. However, this does not seem to be the case. The goal of this project is to try and implement computer programming, through Scratch, as a tool for educating students in math and science topics. Computer science education at a younger age becomes more and more essential as computers become more advanced and more accessible with each passing day.

1 Introduction

The main question that this research project aims to answer is, "How young is too young to start teaching children how to program?" The goal is to establish a computer science program at Cardinal Forest Elementary School through the use of the MIT developed program 'Scratch.' Hopefully by watching how the students use the program I will be able to come up with an answer to the question. Despite the fact that I will be graduating at the end of this school year, I hope to continue my partnership with Mr. Allard and Cardinal Forest throughout my college years in order to ensure that the program continues, and to see the results of my initiative.

This paper will detail both how Mr. Allard and myself will teach the students, and how the students go about solving the problems that they are presented with. Mr. Allard and I will develop a curriculum based on the Virginia Standards of Learning (SOL) and Program of Studies (POS) standards for the students. The children that participate in the program are in first through sixth grade, with each grade having a similar curriculum scaled to the necessary level. Not all of the elementary school students will be participating in this project however. Mr. Allard has selected a diverse group of students for this initiative that he think would do best in and benefit from a program such as this.

2 Background

The task of educating the younger generations about programming has been attempted before. The first attempt to create a kid-friendly programming language was Logo, made by Wally Feurzeig and Seymour Papert. This programming language mainly involved telling a turtle how to move around in order to make various pictures with the turtle's "pen." Since then, multiple programming environments and languages have come about to try and engage not only youth but more specifically girls in computer science and programming such as: Squeak, Alice, and Scratch.

Despite the bountiful number of tools that modern technology gives us for teaching students, little progress has been made in teaching computer science at the elementary school level. The necessary technology is present in the schools, but it is only being used to reinforce outdated teaching methods. Currently, computers are mainly being used as a medium to transfer information, much like a television. Computers have so much more potential than that. They should be used as a universal construction material, not as a TV screen. Programs like Scratch enable kids to create whatever they want to all by themselves. Children learn better by immersing themselves in whatever they're doing, rather than just listening to a teacher telling them what to do (Papert, 1993).

The goal for this project is to establish something akin to a Computer Clubhouse at Cardinal Forest Elementary School. The original Computer Clubhouse was started by the Massachusetts Institute of Technology in Boston in 1993 to "provide more young people with the opportunity to become digitally fluent." (Resnick, 2002) At these clubhouses, kids and older youth



Figure 1: Some girls working on their projects

”become designers and creators with new digital technologies. Clubhouse members use leading-edge software to create their own artwork, animations, simulations, multimedia presentation, musical compositions, websites, and robotic constructions.” (Resnick, 2002) I want to start a computer science program at Cardinal Forest where students can think for themselves and create whatever they can imagine.

3 Development Sections

3.1 Timeline

This past fall, I contacted the principals of the middle and elementary schools in the West Springfield pyramid inquiring about the possibility of starting a computer science program at their schools. Only one school replied (Cardinal Forest) and the principal referred me to Mr. Allard. October and November were spent sorting out which programming language to use and how we were going to use it. After experimenting with 'Squeak' and 'Alice' we decided on 'Scratch.' It was decided that the Scratch Lunch Bunch as it has come to be known would meet during Lunch on every Thursday. I personally teach the students every other Thursday.

3.2 Lessons

Each class lasts from 30-45 minutes, depending on the age of the students attending. Thus far, Mr. Allard or I instruct the students on what to do for a majority of the time, but this is not our end goal. As the year moves on, we will encourage students to explore the program independently and discover new methods and techniques on their own. We hope that this will not only teach the students how to take some initiative, but we think that they will gain a better, more solid, understanding of the program through individual exploration. Each lesson begins with the students signing in to the lab and quietly sitting down at their computers. Once everyone is seated, we begin teaching. By the end of the year, we hope to simply give students a project idea or category (i.e. celebrations or sports) and have them make a project all on their own.

3.3 Topics

The actual number of topics that can be covered will be dictated by how quickly the students move from one topic to the next. Thus far, the students have been exposed to the coordinate axes, degrees, if-then statements, and basic loops. Multiplication was also brought up in the loops discussion since the two subjects go hand in hand. We did this by first having the students tell their sprite to move in a square by tellin it to move, then turn 90 degrees, move, turn 90 degrees, move, turn, move, turn. We told the students that this type of coding is inefficient and that there is a way to tell the sprite to do the same thing over and over again: loops. We instructed the kids to use the “repeat” loop that is found in Scratch. A square has four sides, so the sprite would have to do the move-;turn sequence four times in a row. Four times two commands equals eight commands, which is what the students started out with.

3.4 Resources

The Cardinal Computer Lab features 30 student computers along with a teacher workstation connected to a Smartboard. While we wish the room was bigger so that more students could be accomodated at one time, these resources are sufficient for the project. Currently, only one parent volunteer has come to the meetings, but other parents have shown interest in getting

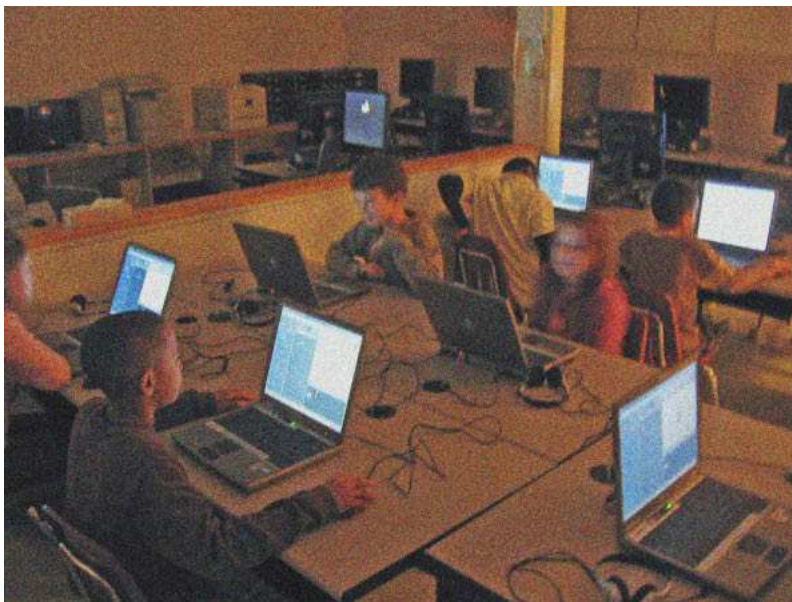


Figure 2: The older, laptop-based computer lab

involved with the program. Mr. Allard will be in attendance at every Scratch session, and I try my best to attend every other one.

3.5 Restrictions on Study

The most pressing restriction for this project is time. Seeing as how I am still a student, it is difficult for me to be at Cardinal Forest during the school day. This limits possible meeting times (when they don't conflict with either Mr. Allard's schedule or my own) to before and after school. This of course carries with it the problem of transporting kids either to or from home, seeing as how elementary schools don't have late buses. Despite these time restrictions, I have full faith that a computer club will be possible at Cardinal Forest and that the research project will be successful.

3.6 Reporting Results

To put data into a chart or graph for this project could be difficult, unless something of an assessment is offered to the kids at one time or another. Mr. Allard and I are reluctant to give such an assessment because we're afraid it could discourage some of the kids from participating in the program. He and I will come up with a way to document the progress of the students. The data

generated from this experiment will most likely be fairly subjective, based on my experiences with the elementary school students, and this would be rather difficult to simply place into a graph. The students were recently given a survey asking about their general knowledge of computer programs and computer programmers. The survey had three questions: “What computer programs do you use_i,” “What *is* a computer program_i,” and “What are computer programmers like_i.” There was an unforeseen problem in handing out this survey: many of the students (more or less from all of the grades) had trouble with the vocabulary. They had never heard of any software being called a “computer program” before, and this caused the survey to take up much more time than it was meant to. I do not have the results from this survey yet.

4 Results and Discussion

As mentioned before, I hope that this research project will yield good results that would encourage the implementation of a simple computer science curriculum at the elementary school level. The earlier that kids can start to program and become interested in programming, the better. The computer has the potential to start a digital revolution in learning, not only in math and science but in English, and social studies as well. By the end of this initiative’s first year, I hope to show how the students have made progress in multiple school subjects as laid out by the SOL’s and that technology gives us better ways to teach the students of today.

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