

# Studying the Effectiveness of Storytelling Alice in Teaching Programming Concepts to Elementary School Children

Amanda Gilbert

## Computer Systems Lab 2009-2010

### Abstract

I will be working with students at Cardinal Forest (mostly girls in the 4th grade) to observe how well young children are able to grasp basic programming concepts presented in Storytelling Alice. I will be presenting the concepts through material that corresponds with the English and Mathematical standards as determined by the Virginia Standards of Learning. The end goal will be to measure the success of students in attempting Python after a successful Storytelling Alice background. This will show whether or not the students are developing a strong foundation in computer science from Alice.

### Background and Introduction

Storytelling Alice was created by a student at Carnegie Mellon University named Caitlin Kelleher. Last year, two girls did a research project at Cardinal Forest Elementary but focused on Scratch programming. This year, Mr. Allard decided to add Storytelling Alice as another language for students to study and I have been put in charge of the mentoring program for this language. This is the first year we will be testing Storytelling Alice at Cardinal Forest Elementary. However, it is not the first time Storytelling Alice has been used to teach young children to program.

Kelleher was interested in developing Storytelling Alice for many reasons. In her PhD dissertation, she recognized how important diversity is in the field of computer science. She felt storytelling Alice could help attract middle school girls to computer science and geared her language toward that group. Kelleher mentioned a study that found that boys' and girls' ideal technologies were significantly different. Because of this, having a more equal ratio of girls and boys in the field could drastically change the course of technological development.

One article I read about Alice programming dealt with girls and their ability to use Storytelling Alice to learn programming. The article stated that girls have the same ability as boys do to program. This was encouraging for my project because not only am I a girl interested in programming as a career, I hope to spark an interest in programming in the girls I mentor. These researchers also stated that there were many reasons why girls were less likely to choose to pursue a career in programming. Not only are there social norms that encourage boys to program and not girls, at the middle school level, girls confidence in their abilities relating to math and science becomes deflated. This is actually a very promising fact for our study. Because we are working with Elementary School students, not only are we able to encourage programming for girls before they reach middle school level and lose confidence in science-related subjects, we are also working with them at an age when they are unlikely to know about social norms in programming. Hopefully, Alices easily understood set up will help give girls confidence and Alices storytelling nature will be attractive to girls.

Another article I read simply studied Storytelling Alice and game making. Both articles mentioned that Alice is very successful in teaching algorithmic thinking and basic programming language and syntax to children. A third article I read discussed the difference between teaching programming with Storytelling Alice and other gaming centered programming languages. Because the gaming community is predominately male, a programming language with a gaming nature would be more attractive to males than females. Storytelling, however, is attractive to both males and females and, if taught at an early age, could help equalize the number of boys and girls interested in programming.

There are other benefits to using Storytelling Alice. Concepts that are hard for first-time programmers to understand like variables, parameters, and loops have to be introduced through assignments in other languages. In Alice, however, they are incorporated into the foundations of the language.

Quiz One

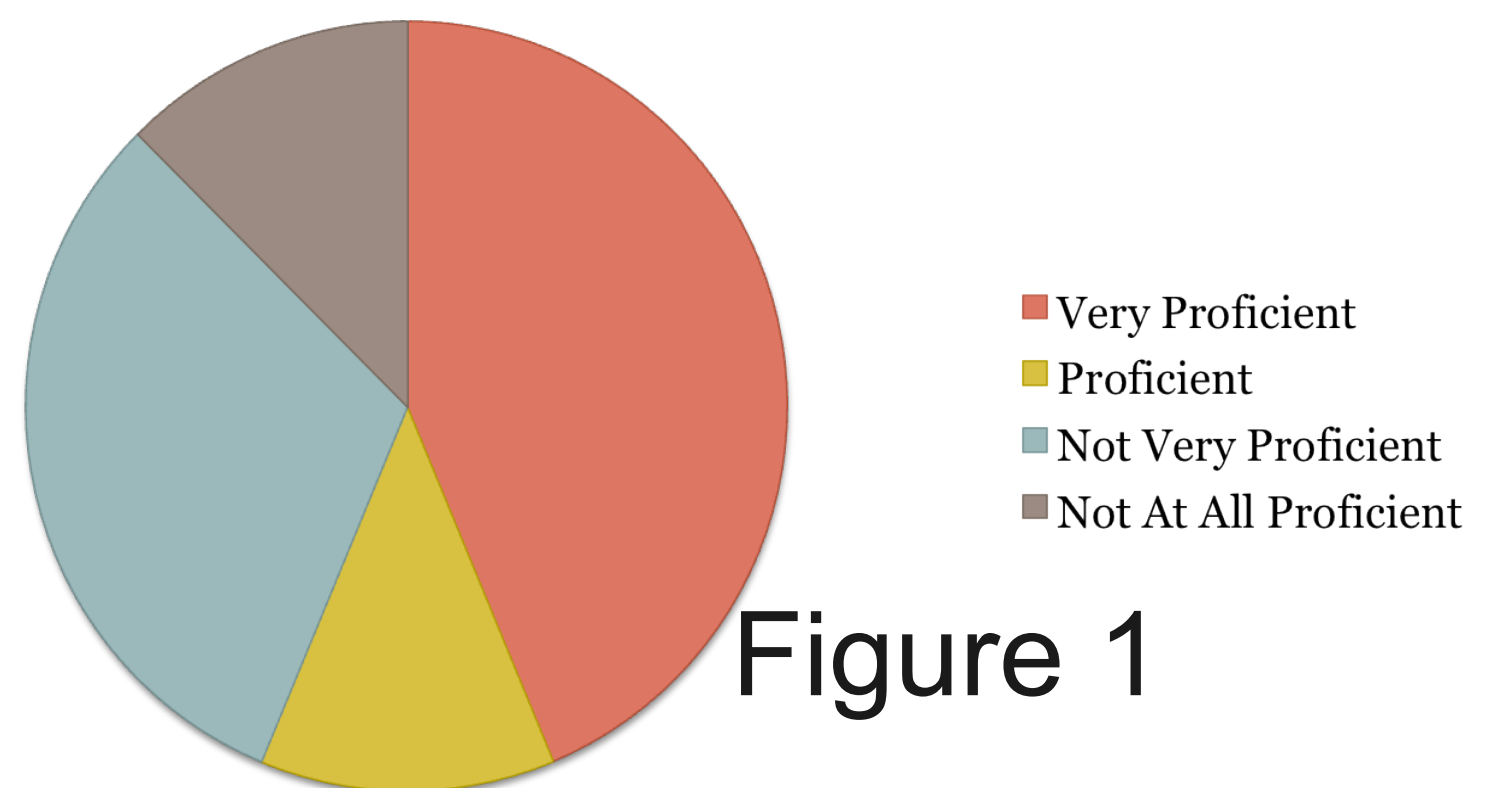


Figure 1

### Discussion

Each Tuesday, I work with a class of fourth graders. There are only three boys in the class (the majority of the students are female). We have worked on three projects together in class so far this year. The first dealt with establishing knowledge of how to create a world in Alice.

The children learned how to add objects and adapt them. They also were introduced to Alice's arrows and learned how to scale using them. The second lesson introduced them to creating methods in Alice using the convenient drag-and-drop interface. They learned about control statements such as Do In Order and Do Together.

They also learned the four values that are important in Alice: Booleans, Strings, Objects and Numbers. The next class, we had a quiz that tested their understanding of control statements and how they effect the order of the methods. The final project we worked on during second quarter was a story that they had to create into a program in Storytelling Alice. We first looked at the story and determined the setting and characters. We worked together in class to make the methods and write the code, essentially from scratch.

### Results and Conclusions

I have collected one set of data because I have given one quiz to the kids in my class. The results can be found in figure one. Very proficient was defined as 80%-100%, proficient was defined as 50%-80%, not very proficient is 20%-50% and not at all proficient is 0%-20%. Out of a total of 16 quizzes, there were 5 perfect papers. This spread is very promising for my project because I was hoping to have about half of the class ready to learn Python by the fourth quarter. The children that are "very proficient" are thinking individually and are able to write out the program and not simply drag-and-drop methods. My eventual goal is to teach those top-of-the class students how to program in Python. If I am successful in this task, it will show that Storytelling Alice is effective in not only teaching children how to program, but also in preparing them for a career in programming beyond the Alice world.