

- In order to give the user a tutorial and instructions, we took screenshots of the game and included speech bubbles throughout each step. This allowed for a step by step instruction process for the user to see before they began.
- In order to evaluate any learning gains, pre and post tests were written to be completed by the participant before and after the game play. This included five multiple choice questions about the three specific sorting algorithms and the steps taken to reach the final sorted list
- During game play, we recorded the player time and actions such as incorrect passes and swaps in an XML file. Later, a log file parser we wrote turned the XML file into an easier to understand text file. The log parser also took pre and post test logs and placed them into an Excel file for easy score evaluation.

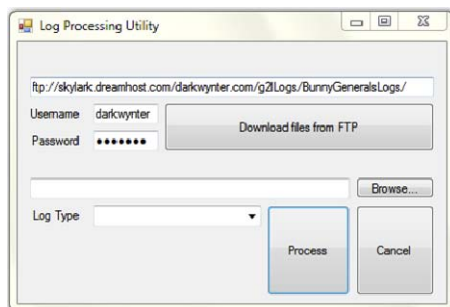


Figure 2: log file parser for Bunny Generals

## Results

A preliminary study was conducted on 17 high school boys and 1 girl. Participants were unfamiliar with Computer Science concepts and therefore the study served as a way to receive feedback and see how the final study would take place. Participants showed insignificant learning gains through pre and post test results. However, after speaking with the participants there was a better understanding of sorting algorithms after playing the game.

The final study consisted of 8 undergraduate and 2 graduate students where

gender was divided evenly. 8 of the participants were majoring in a computing related field, while 2 were unspecified. The averages on both the pre and post test turned out to be the same, but after speaking with participants 2 ambiguous questions were deleted. This showed more of a learning gain then with all original 5 questions.

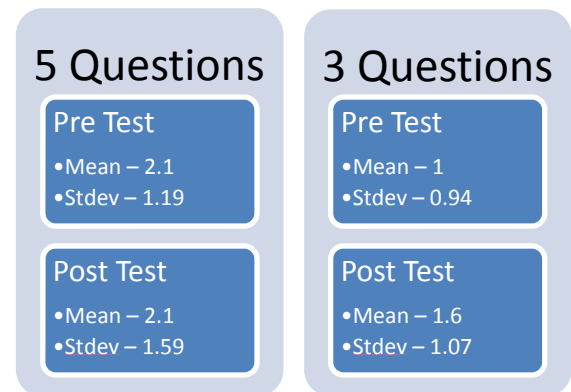


Figure 3: Statistics on final Bunny Generals study

## Future Work

After seeing participants interact with the game, many problems were identifiable that need to be resolved.

- Redo pre and post tests to remove ambiguous questions
- Get more study participants
- Allow errors so student will learn from mistakes
- Improve visualizations of algorithms, especially selection sort
- Improve layout of HUD and usability for players

# Bunny Generals: Teaching Sorting Algorithms through Video Games

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## Introduction

In the Game + Learning Lab this summer, we created a game to teach introductory sorting algorithms to higher level Computer Science students. The game was designed to step through the bubble, insertion, and selection sorting algorithms and provide the user with a visual and interactive method of learning. I succeeded in completing the survey and tests requirements for the study, the tutorial screens for each level, and mapping out the different level environments. I also evaluated the final data to produce the learning gain results.

## Background

While other fields of science and engineering have increased or at least maintained their number of graduates, computer science has shown a marked decline, especially in the number of women graduates. Our goal is to give students an alternative way of learning in comparison to traditional Computer Science assignments, and many studies have been done to prove that this method is effective. Students report feeling less intimidated in the

classroom, and teachers notice a better enthusiasm with students when assignments are familiar gaming environments. With our game, students would have a better visual representation of each sorting algorithm and would effectively learn the concept by interacting with the game.



Figure 1: Level 3 of Bunny Generals- Selection Sort

## Methods

- First, we had to complete all necessary IRB applications and protocols and get approved by the IRB board. This included a small course on Research ethics when dealing with human subjects.
- Since we had started with only one level and added levels as we went, we had to separate out the level logic because it was impossible to keep it all together in our code since they were so different.
- We also completed different level maps in order to give the user a different visual world for each level. This helped the user distinguish between each algorithm later. We used the available XNA RPG tile engine which included indoor and outdoor scenes.