Teaching Coding Concepts through Gaming

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PURPOSE AND GOALS:
The lack of diversity in STEM fields has come to light in recent years. Women and people of color are drastically underrepresented, specifically in the field of computer science. Both groups show significantly less interest in programming after middle school due to lack of opportunity and representation. This research aims to bridge the gap and create more interest in computer science through the middle school years.

Inspired by a lecture from Shahnaz Kamberi at the Grace Hopper Celebration of Women in Computing, this project intends to engage users by combining gaming and programming concepts, and targeting these games towards pre-teen girls of color with the hope of establishing a more diversified IT industry. The talk outlined Kamberi's study which consisted of a gender specific "Sims"-esque game that taught girls age 13-17 basic concepts in Java using the Eclipse IDE. Both the control group and the game group had almost identical results. Girls had an increased interest in computer science and average scores for the pop quiz were approximately the same.

Our main goals were to investigate the following:
- Is a video game an effective avenue to teach basic programming concepts?
- Compared to traditional teaching, is video game teaching more effective?
- How can the video game be altered to target women and people of color?
- Does the game garner a larger interest in computer science for the target group?

METHOD:
11 participants were used in this study. They were undergraduates from Simmons College, with the exception of one graduate student. We recruited them from all over the college using flyers and the Psychology Research Participation Program. They ranged in ages 17-24 and were mostly female and white. Our approach utilized pretest and posttest measures to determine improvement in coding related skills. The participants, most of whom had never coded in any way beforehand, were given a pretest to measure their

coding skills. Participants then played the games designed to teach coding concepts. Afterwards, they were given a posttest to measure their coding skills learned from their code concept learning experience as well as a user satisfaction and demographics survey. Were analyzed the results using a paired difference t-test for the pre- and post- test scores in SPSS.

Initially we wanted to use children in our testing groups instead of undergraduates. Unfortunately, would could not find a consistent participant pool of our target audience and had to give up on that endeavor, though we do plan on pursuing more opportunities over the summer. This also means that we did not compare the game and tutorial groups, because we never had a large enough participant pool to compare both groups. This will also be pursued over the summer.

RESULTS AND CONCLUSION:
The results of our analysis are as follows: the pre-test score mean was 1.68 (SD = 1.42) and the post-test score mean was 3.27 (SD = 1.27). The paired t-test comparing the difference of this score, had a mean of 1.59 (SD = 1.39, t = 3.79, p = 0.004, 95% CI: 0.66 - 2.53). The results implied the improvement in scores was statistically significant, though it may not have been practically so. However, the majority of our participants believed that the game would be moderately enjoyable for a child and that the python concepts that the children would learn in our games would be novel to them, leading us to believe that the early stages of our game is a success. We saw this reflected in our pre-pilot with the girls of Strong Women Strong Girls. The girls were from grades 3-5. Only a few of them had prior coding experience but by the end of the pre-pilot almost all of them showed an interest in programming.

Women and minorities continue to be underrepresented in the field of computer science. By establishing a more interactive and effective learning model, we hope to encourage both women and minorities at that pivotal point in grade school, to gain an occupational interest in the computer science field.

DELIVERABLES:
- Demonstration Website - Used during testing:
  http://anita.simmons.edu/~creu/CREU2015/demo/
- Panel Presentation - Presented at the Simmons Undergraduate Symposium:
  https://docs.google.com/presentation/d/1VN2eLN_5Ww7qVxxUFUmGtzKj0qU03FanSlcZP0OzP1g/edit?usp=sharing