Math Edutainment Software for Girls Grades 1-6

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Period 2

Abstract

The purpose of this project is to create an engaging and educational game for elementary-aged girls. This edutainment game will be driven by a comprehensive plot, a diverse cast of characters, and seven different mini-games. Through an all-female cast of scientists, a feedback system, a stereotype-free presentation of science in the real world, and rewarding game play, the game will encourage these girls to pursue higher-level math, science, and technology classes.

Introduction

Despite progress in recent years, girls are still behind in math and science enrollment and scores. Many girls feel unmotivated to continue their educations in math and science past the necessary level. As such, girls are underrepresented in college-level math, science, and technology classes ("GMSP Stats"). Many girls feel unconfident in their ability to perform math and, as such, avoid it except for when absolutely necessary. Other girls find math impersonal, uncreative, and all memorization ("Girls' Beliefs"). This project is attempting to overturn these beliefs and behaviors and encourage girls in elementary school to eventually enroll in advanced math classes.

This project includes creating a web-based "edutainment" game – a piece of educational software that is meant not only to teach but also to keep the student engaged, entertained, and interested in the subject – and making it available to elementary schools in Fairfax County. Students' beliefs before and after game play will then be compared.

This game will implement a series of features to help counter several common problems with girls' beliefs, behaviors, education, and attitudes.

Background

Many girls shy away from taking advanced science, math, and technology classes. Research done by the Girls, Math & Science Partnership states that despite recent advances boys still outperform girls in primary education science, math, and technology classes. Boys' math SAT scores are, on average, 30 points above girls', more boys than girls are enrolled in Advanced Placement Computer Science and Physics classes, and eighth grade boys typically have higher performances than girls in fractions, number sense, and the core sciences, in addition to a higher scientific confidence.

Concerned with this problem, several groups have created suggestions to help encourage girls both in the classroom and out. The Girls, Math & Science Partnership suggests making math more personal, helping girls appreciate math and science for its virtues instead of its utility in school; giving girls the feeling of control over their abilities in science and math; creating a "New Science Girl" archetype to break the "math is for geeks" stereotype; reminding girls that math and science can have rewarding, inspirational, elegant, and humanitarian aspects; and encouraging girls to explore what they can do with math and science. The Institute of Educational Sciences suggests teaching girls that their cognitive abilities are not fixed; giving girls specific feedback; providing strong female rolemodels; linking math, science, and technology to unusual (non-stereotypical) and interesting careers and activities; creating opportunities for research; and providing spatial skills training. The Commission on Technology, Gender,

and Teacher Education suggests implementing strategy, personal interactions, diverse and interesting characters, narrative plots, non-stereotyped creativity, and appropriate challenge into "edutainment" games.

Preliminary Testing and Analysis

To counter several of the problems discussed above, I will be implementing a number of features. These include:

- Evolving, narrative plot and score tracking

- Feedback, suggestions, and the ability to "study"

- Cast of non-stereotyped female characters

- Presentation of female role models

- Links to interesting math, science, technology projects and activities

- Presentation of science in the real world

- Teach spatial skills through a game

- Engaging characters with social interactions

- Diverse cast and character customization

- Creative (but not in a stereotypical way) game

The plot is based around a fictional space station on a fictional planet staffed by a multiethnic cast of female scientists and engineers. The player has arrived after an unusual and unexplained accident has caused several (relatively benign) problems on the space station. In order to return to Earth, the player must help the space station team fix the various problems. The more levels of the mini-games the player completes, the more

the plot is revealed to the player. After completing five initial mini-games, the player must activate an "artifact" through a sixth mini-game to make contact with an alien race on the planet. The player must then complete the final mini-game to decode the aliens' language, at which point the player has formed an alliance between the space station and the aliens and can return to Earth. This will all be conveyed through cut scenes and character interactions (which will both be implemented in their full extent in the second or third quarter). A score tracking system will also be implemented second quarter, which will allow the player to see how many levels of each mini-game they have completed at any time.

When the player answers a problem incorrectly, the character running that mini-game will provide suggestions to the player (such as "Try writing it down on paper" or "Look at the tips in the Engineer's Notebook for more help"). Although this is not terribly specific feedback, it is more helpful than the ever-present "Try again" or "Better luck next time". The player will also have a way to study facts, tricks, and tips through the aforementioned "Engineer's Notebook". One character will have an interactive "book" for the player to flip through a read. This book will provide common math tips and tricks (to help the player "study"), information about famous female scientists (to provide positive role models), information about the game's characters and what their jobs are (to present science in the real world), and links to interesting science, math, and technology activities (to remind girls that math and science are interesting and to provide opportunities for research). Both of these features will be completed in the next two quarters.
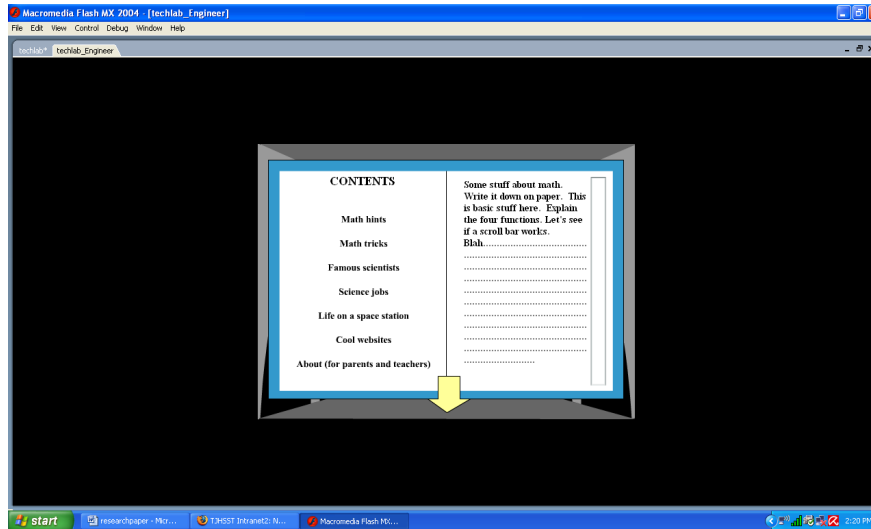
Figure 3.1 – "Engineer's Notebook"

Several of the mini-games will be created to address specific problems. One of these is the spatial skills game. In this game, the player will be shown a folded cube (called a Quadritile in game) and asked to match it with an unfolded cube (one out of three). Another such mini-game will be a robot creation game, which also focuses on logic. The player will be given a series of objectives the robot has to perform. By clicking on various components with special properties (and some just for creativity's sake), the player will be able to create a robot that can successfully carry out its mission. Currently, the spatial skills game is complete (minus a few bugs); the robot creation game will be created in the second quarter.
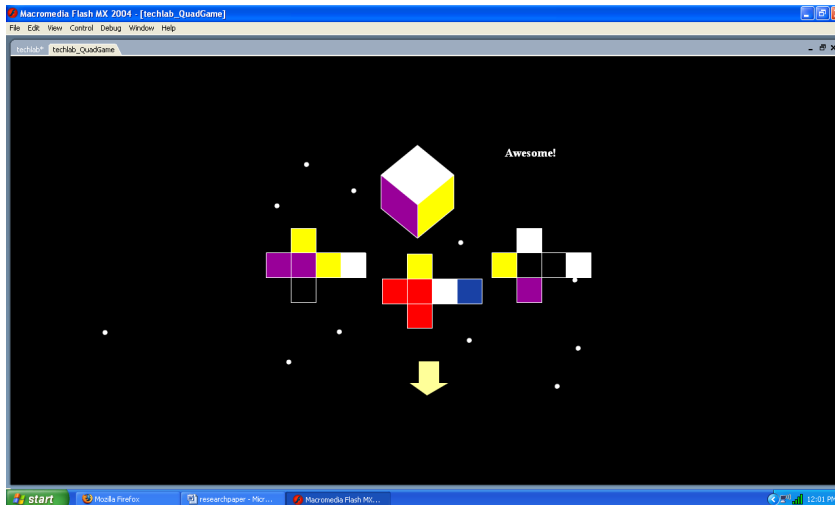
Figure 3.2 – Spatial skills game

The characters are also a very important part of the game. In order to help the player better identify with the characters in the game, before the game starts the player creates a character of their own. This character is relatively simple (e.g. the only clothing you can change is the shirt color), but the female character has an option of several ethnicities and is presented in a way free of stereotypes.
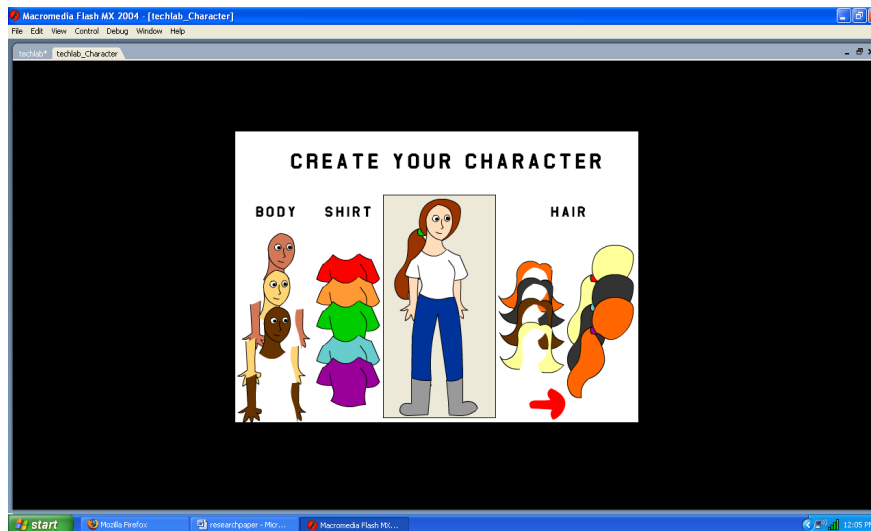
Figure 3.3 – Character customization

At this point, about a fourth of the project is completed. I have all the menus, the loading bar, character customization, interactive characters, two mini-games, and the notebook feature in various stages of completion. In second quarter I plan to finish the other five mini-games, animate a few cut scenes, and flesh out the notebook feature with some common math tips and links to my research and a few girls in math and science websites. To test my program at these stages, I (or another student) will play through the game to make sure that all games can be completed and all scenes can be accessed.

Works Cited

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