CHOICES AND CONSEQUENCES: A GAME-BASED RISKY BEHAVIOR PREVENTION PROGRAM

by

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ABSTRACT

CHOICES AND CONSEQUENCES: A GAME-BASED

RISKY BEHAVIOR PREVENTION PROGRAM

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Serious games have been defined as a mental contest played with a computer in accordance to specific rules that use entertainment to further government or corporate training, education, health, public policy and strategic communication objectives. There have been various studies done to gauge the effectiveness of serious games to teach and engage. In collaboration with professors in social work and computer science, we have designed a multiplayer, social, serious game called Choices and Consequences (C&C) in an effort to better reach the audience of pre-teens and teens in order to reduce the risk taking behaviors of youth today. The game specifically targets the subjects of healthy relationships, conflict management, and giving and receiving advice from peers and adults. The game was created with a game engine, made to run on

Android tablets, and incorporates such technologies as an Apache server, a social network, XML files, and MYSQL database. C&C was tested at a local high school with 40 students playing the game and resulted in showing the efficacy of game implementation in the classroom. Through competition, teamwork and peer and teacher interaction, C&C was designed to teach students to think before they act, evaluate their options and that it is possible to live a healthy and risk-free lifestyle while still having fun in their daily lives.

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CHAPTER 1

INTRODUCTION

Games have been around for thousands of years. Checkers can be traced back to 1400 B.C. and chess is at least 4,000 years old (20). There are many different categories of games including dice games, board games, and more recently electronic games have been introduced. The very first graphical video game was created by William Higinbotham in 1958 called Tennis for Two (19). Games were initially created for the purposes of pure entertainment and since the 1900's there has been an interest in combining games and education (18). In the 1990's edutainment games appeared. These games were primarily PC games and were played by preschoolers with their focus on mathematics, reading, and science. Edutainment games have been described as "kill and drill" type games; the players repeated the same things over and over. Because of this aspect, these edutainment games were not appealing to the players and very quickly became repetitive and the genre died out (9).

In 2002, a military tactics style game called America's Army was released. It was created for pure entertainment, but the importance of it as a recruiting tool for the army was quickly realized and today it is used as a training simulator for the US Army. America's Army started a revolution in thinking about the notion of combining entertainment with education (6). Soon after, the term to describe

these kinds of games, “serious games,” was widespread and the Serious Games Initiative was created (9). Zyda offers a definition of serious games as a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy and strategic communication objectives. Like edutainment games, serious games have an educational agenda. Unlike edutainment games, serious games are designed with entertainment in mind first and with education as a supportive factor. In doing this, the creators of serious games are trying to make the playing process more entertaining and engaging to the players (6).

The motivation for this thesis comes from the behavioral patterns of the youth of today in the US. Presently in America, youths are participating in many different high risk behaviors such as drug use and alcohol consumption. According to the Centers for Disease Control and Prevention (CDC), 11% of all the alcohol consumed in the United States is contributed by persons 12-20 years old, with 90% of that being binge drinking. Kids who participate in drinking, binge drinking or otherwise, are more likely to participate in behaviors such as being sexually active, smoking cigarettes, using marijuana and other drugs, along with many other high-risk behaviors (11). The 2000 National Household Survey on Drug Abuse reported that among youths between 12-17 years old, 9.7 % had used some kind of illicit drug in the past 30 days (13). There are also an alarming number of pre-teens and teens that have been involved in violent relationships, about 10% of adolescents nationwide were reportedly victimized (14). For this

reason, there are many different prevention programs being implemented and studied in an effort to educate and inform kids of the consequences of these behaviors. Most of these programs revolve around classroom discussions with teachers and peers and reading informative material (15) and/or participating in question and answer type classes (17). Although some of these programs have shown progress (15, 16), this thesis is aimed at implementing some of these same tactics into a serious game called Choices and Consequences.

Choices and Consequences is a serious social game developed with social workers in an attempt to better reach the audience of pre-teens and teens on the subject of building healthy relationships, learning conflict management, and the ability to give and seek advice from both peers and adults on various subjects. Through competition, team work, and peer and teacher interaction, Choices and Consequences teaches the students to think before they act, evaluate their options, and that it is possible to live a healthy and risk-free lifestyle while still having fun in their daily lives.

CHAPTER 2

RELATED WORK

According to Garris, all games embody six distinctive characteristics. These characteristics include fantasy, rules or goals, sensory stimuli, challenge, mystery, and control, all of which can be harnessed to produce learning. In addition, Garris also describes the game cycle, or the process of computer game play. The game cycle is a continual loop of "judgments-behavior-feedback" that Garris describes as creating the experience of flow in users (27). Flow, defined by Csikszentmihalyi, is "the state in which people are so involved in an activity that nothing else seems to matter" (28) and "it is this feature of game play that training professionals hope to capture and incorporate in instruction applications (27)."

Furthermore, Oblinger describes today's learners as the Net Generation or anyone born after the 1980’s. In her article, she describes the Net generation as being digitally literate, meaning they intuitively know how to use technological devices without being told, they are connected at all times, respond and expect responses immediately and would rather learn by doing. In addition, the Net Generation is extremely social. Because of these characteristics, Oblinger argues, their learning preferences are different as well. The Net Gen would rather work and learn in teams with peer to peer instruction being preferred. This

generation is also “oriented toward inductive discovery or making observations” and they “crave interactivity.” Oblinger also notes, because of their impatience when receiving information, they are prone to not paying attention in class unless it is interactive and engaging (21). Prensky also makes this distinction, but instead he calls the generation of kids who have grown up with technology the Digital Natives and the adopters of technology the Digital Immigrants. Because of the technologically inclined Digital Natives, the Digital Immigrants must change their teaching methodologies to a faster pace to match the students’ learning style. In addition, the teaching material must be changed to incorporate the old content with new content. Prensky describes this new content as not only digital and technological, but including such things as sociology, language, ethics and other things that interest the students (22).

As Oblinger and Prensky have described, students today have changed and, as Garris states, games can be harnessed in such a way to educate students. Consequently, there are various studies that have been conducted to determine what kind of games are optimal in teaching, what methods are considered to be best in which to employ these games, and what students react best to serious games. In this chapter takes a look at some of the recent studies done on ways to incorporate technology into the learning environment.

Annetta’s study involving a teacher-created Multiplayer Educational Gaming Application, or MEGA, was conducted in 4 biology classes in the Eastern United States. Its goal was to examine the impact of video games on the ability to

learn and stay engaged in the particular subject of genetics. MEGA was designed and created by the teacher of the class in order to stay on track with the curriculum. The study was conducted with a control group and an experimental group. The control group consisted of 3 classes with a total of 63 students (28 males, 35 females). The experimental group consisted of 66 students (35 males, 31 females). Both groups had the subject of genetics taught to them by the same teacher and received the “business as usual instruction,” which included “whole group lecture, hand-on inquiry-based activities, small and large group discussion, and independent practice.” The difference between the two groups was the type of unit review each participated in. The control group was to review the material on their own and participate in a group discussion, whereas the experimental group reviewed the material through MEGA.

MEGA was conducted with the students playing in pairs for one block of 90 minutes on a PC desktop in the computer lab. The game revolved around a murder-mystery in which the students were the detectives. The setting of the game is based in a mansion of a deceased couple, Mr. and Mrs. I.M. Megabucks. This couple left behind a large inheritance that was stolen from their safe, of which only family members know the combination. The story is told by Mr. Megabucks, giving the family history and allowing the students to set up a pedigree of the family. The student is given further clues from the butler, who witnessed the burglar fleeing the scene and observed the criminal having a bent thumb. Another clue consisted of blood on the floor at the crime scene. From

these clues the students were to use their understanding of pedigrees, DNA fingerprinting, blood types and Mendelian inheritance to solve the mystery.

This study assessed the impact of MEGA on the students understanding of genetics by administering a genetics unit test after the experiment. It was determined that prior to the study, the students all had a similar knowledge of the subject by averaging the participants' previous three report cards. Review of the genetics unit test proved that playing MEGA did not significantly impact their test scores. The author argues this may be due to many factors, such as the students having a skilled teacher and so the review process would have not impacted their understanding anyway. Also, game players spend a large amount of time examining their surroundings before they play and since students only played MEGA once, it is suggested that this may have hindered the learning process.

In addition to examining understanding of the material, Annetta also assessed the students' engagement. The participants' engagement was measured by the Protocol for Classroom Observations from the Annenberg Institute for School Reform. Two researchers analyzed video tapes from the classrooms. This analysis indicated that students using MEGA were more engaged than the other students.

Annetta concludes the study by stating that because of the higher engagement of the students, gaming can be used as a tool to "hook" the students and encourage further desire for understanding the material. Annetta also suggests that instead of just a review instrument, MEGA be used as a pre-

assessment of the students' knowledge and also either as a review or to gauge what was learned in the course. In any case, Annetta believes further research is needed to determine the effects gaming can have on education (2).

Another study done in 2000 by Rosas was conducted in Chile among 1274 students from economically disadvantaged schools. In this study, the researchers split the students into 3 groups: experimental groups (EG), internal control groups (IC), and the external control groups (EC). Students in the experimental groups were given a hardware was identical to the Nintendo Gameboy. The software consisted of 5 different games, aimed at teaching the students "basic reading decoding skills as well as basic math skills." Each game was created with 5 design principles. One, they wanted to encourage "incidental learning," or unplanned learning. Two, the games were designed around the school curriculum with increasing level of complexity. Three, the games were to have increasing difficulty and would provide feedback. Four, the game would dynamically change to fit the child's pace based on their performance. And, five, the games were to look like commercial games that were intended for entertainment. Four of the games had a story line such that the student must pass levels to progress to the next and one of the games was the traditional Hangman game.

All schools were chosen so as to have similar academic standings and economic standings. Both the EG and the IC groups were in the same schools and therefore both groups knew about the study. The EC groups were located in

different schools and had no knowledge of the study or the games. The experiment was divided into three different phases. First the teachers were trained, second the game was implemented, and third was the assessment. The game was played from 20-40 minutes a day inside the classroom and the teachers were free to choose which game was to be played during this time. Many different pre and post tests were conducted concerning motivation and learning. Statistically, there was no difference in learning between the groups in the experimental schools (EG and the IC), although there was a significant difference between these classes in the experimental schools and the external control group (EC). This gives a strong indication of the Hawthorne effect, or that people modify their behaviors because they know they are being studied. Also, as the author points out, it is important to note that game play did not result in a negative effect, even though about 30 hours of the regular curriculum was being taken away by game play. As for motivation, there was a significant preference for the video game over regular classroom activities. In fact, a lot of teachers would use this to their advantage by promising game play in the beginning of the class to encourage students to show up to school on time. In short, the video game taught the students the necessary classroom objectives, promoted self-esteem, peer cooperation, student interaction and motivated the students to show up to school. Rosas challenges the researchers of today: “Besides studying the harmful effects of violence and gender bias, more scientific studies should focus on the effects of using video games with educational contents (5).”

Ritterfeld did a study in order to separate the effects of multimodality and interactivity that are contained in serious games to try and analyze separately their effects on learning the digestive system. Multimodality is the property of serious games that allows for the presentation of knowledge in an environment that involves “visual, auditory, haptic,” and other senses. Interactivity is the property of the gamer to communicate with the gaming system through various activities. The study was conducted with a serious game called Metalloman, which was designed to teach the digestion system by having the gamer try to save the human race from an alien virus. The player was to get inside the human body to perform tasks in order to help the digestive system function.

In order to examine multimodality and interactivity individually, Ritterfeld separated the experiment into four conditions: game, game replay, hypertext, and text. The game condition required the participants to play the game, thereby involving both interactivity and a high modality level. The game replay condition required the participant to watch a recorded video of another participant playing the game, which involved a no interactivity and high modality level. The participants of these two groups (game and game replay) were paired together based on their sex, age and expertise at digital game playing. One of the matched participants played the game while the other matched participant watched the replay of the game play of the other. The hypertext condition consisted of the same interactivity as game playing but did not include the visual and acoustic animation, only screenshots of the game thereby giving it the

property of interactivity and a low modality level. The text condition was very similar to reading a book with color illustrations, thereby giving it the property of not being interactive and having a low modality level.

The participants were composed of undergraduate students from a private western US university. Extreme outliers were excluded with the final sample consisting of 100 students, 25 in each condition, with 20 males, 80 females. The participants were given a 20 question multiple choice test before (pretest), directly after (posttest), and a week after the program (follow-up test). Also, the participants were to write an essay after the program. Correlation analysis performed from the study showed self-reported learning and gained interest were positively correlated as were knowledge gain at posttest and gained interest. The results showed a higher knowledge gain in game replay compared to text and game play compared to hypertext, giving support to multimodality having a positive impact on education. The effect of interactivity was mainly examined between the replay and game conditions and was shown to have an impact in knowledge gain as well. Although the multiple choice questions showed significant differences, the essays indicated “shallow learning.” Ritterfeld gives a summary of the findings in the discussion section: “taken together, this study provides empirical evidence that interactivity and multimodality individually contribute to educational outcomes, especially definitional knowledge gains (24).”

In a study conducted by Rose, the authors created a board game called *Race to Glucose*. The board game’s main objective was to teach the players how

the metabolic pathways relate to one another, their reactions and regulations, and to enhance the players' enjoyment in learning about metabolic pathways. The game was played by rolling a dice and navigating your piece through the metabolic pathways to reach the end. On the way, there are purple spaces and blue spaces in which the players can land on. If the player lands on a purple space, they must answer a quiz question to continue. If the player lands on a blue space, the player draws a condition card and they are to respond accordingly to the condition, such as "move back three spaces".

The study was conducted on 94 students on a pharmacy class of 2012. Day 1 of the study, the students took a posttest before being introduced to the game. Day 1 and 2, the students played the game and day 3 the students completed a posttest. The pre and post tests were identical and consisted of 30 multiple choice questions, 13 of which were unrelated to the game content and 17 were related to the game content. Afterwards, 46 pairs of pre and post test scores were collected and analyzed along with a survey completed by the students. In summary, Rose concluded the game did enhance the learning enjoyment of the students, enhanced the game-related question scores on the tests but did not significantly impact the students' scores to the questions unrelated to the game (25).

Civilization III is the third game in the Civilization series that was invented and designed by Sid Meier. Civilization III was released in 2001 and is a turn based strategy game. The setting of the game is 6000 years ago and the players

must choose a civilization to control. They are the supreme ruler of their civilization and make all the decisions through to the present day, provided they do not get wiped out. Throughout the game, the players must make decisions regarding their natural resources, their military tactics, technological advances, their people's happiness, type of government, trade, budget, and many others. The game allows for various strategies such as developing a strong military, dominating the technological advancements, or even building strong economies. There are many ways to win which further promote the adoptions of different strategies. The six ways of winning include:

> a) conquering all rivals, b) constructing a space ship and successfully colonizing Alpha Centauri, c) dominating the world through controlling a vast majority of planet's land, population, and resources, d) controlling the United Nations and being voted the victor, e) culturally dominating the world through cultural hegemony, and finally f) achieving the highest score if no other win conditions are met.

Losing results only if your civilization is taken over or another player wins.

Civilization III's original intent was for entertainment, but the question of using it as a learning tool has been argued. In Squire's dissertation, he took three case studies and implemented the game as part of an educational unit. The first case was implemented at the Media and Technology (MEDIA) Charter School in a lower income Boston neighborhood. The school is designed to help inner city and at risk students and serves mostly an African American population (80%). Squire documents his experience with the students in his dissertation which took place over a 6 week period, an hour of the day, for 3 days in the week. He documented their progress throughout the study. The students' first reaction to

the game was very negative. The first few days of being in the classroom, some of the students had their back turned to him and one even refused to tell him his name. Once they started playing the game, initially they were overwhelmed and frustrated. Squire notes in his dissertation that their interests seemed to peak a little once he tried to convey to them that they get to determine history. He told them that they themselves can choose a civilization, such as the Native Americans, and try to conquer the Europeans. By day 5, most of the students were fluent in the game and asking questions. Squire details their further progression into being “riveted” by the game, asking to take home copies, staying after school to play, and eventually some students turned to history for help in their gaming.

As one of the students said in Squire’s studies, the students were “forced” to learn about other civilizations to survive. It was a common theme that the most successful of the students had to gain knowledge in history and geography in order to achieve their goals. The game encouraged a kind of recursive play where if the students realized their strategy or some of their decisions were not working, they would end the game, devise another plan, and start again. Because of this, the students were constantly asking questions about World history and how it affected their game play. Squire notes that unfortunately they most often came to either him or the teachers in search of the answers instead of textbooks, but the teachers agreed at the end of the study that the simple fact that they were asking questions would have made the unit a success. Some

simple questions and answers at the end of the study proved that the game was most successful in teaching basic concepts to the students, not a deep conceptual understanding of the topic. For example, most of the students understood the effects of some of the types of government, but when asked definitions, they could not produce them.

Squire's study showed that playing Civilization III did engage the students into the subject of world history, of which was considered a "boring" subject. Not all the students were responsive to the game, but the ones that were showed a lot of interest in the subject. This, along with the fact that the game was not actually "factual" history, leads to the conclusion that the game could be used as an introductory tool supported with factual information from the teachers and not used exclusively for classroom instruction. Squire also concludes saying the "social context surrounding the game play proved to be as important as the game itself in engaging students and promoting learning (26)."

Pagnotti and Russell III also researched the addition of adding video games into a history class, this time with Civilization IV, the follow up version to Civilization III. Civilization IV operates on the same premise as Civilization III, the player chooses a civilization to control throughout history and devises a strategy to keep their people alive and thriving. Pagnotti's study was specifically aimed at teaching the students of a ninth-grade history class the effects technology has on the development of a civilization. The study was conducted in an urban public school in Florida and spanned two days. Each day the participants were to

choose a civilization to control and develop. The first day the players were not allowed to develop technology on their own, they could only trade and barter for it. The second day the production capacities were balanced throughout, making it possible to choose whatever strategy they wanted regarding technology. After two days of playing the game, the class discussed the results and compared their scores of the two days. They were also asked to write an essay and given discussion questions to guide their responses.

During the study, the students were “heavily engage and never observed off-task during game play” and discussions throughout the implementation were “lively, engaging, and captivated students’ attention.” During the beginning of game play, most of the students decided that devoting the most amount of time towards making their civilians happy was the best course of action rather than devoting time for technological development. In the first day of game play, most of the groups had to restart their game due to the fact that their civilization was overtaken. These students could not compete with other advanced civilizations. The discussion that took place after game play showed that although the students realized the importance of technology in their civilization, they also realized that it was not in their best interest to choose just “one or the other,” but they needed to prioritize. These discussions showed the “students had moved beyond simple responses toward answers that required higher-order thinking skills.” Overall, Pagnotti’s study showed that Civilization IV can be used to not

only engage students but can also “encourage high-order thinking” and “motivate students to take ownership of their learning (30).”

It's a Deal! is a serious game created to teach three specific areas of intercultural communication to students of business. These areas consisted of intercultural awareness, intercultural knowledge, and intercultural competence. *It's a Deal!* was created with the main challenge of making a deal with a major toy distributor. The game is composed of 7 episodes in which students must use their knowledge in business English in the different stages of sales operation. During each episode, the players are to make choices that are scored based on their "effectiveness and appropriateness" and then debriefed on their performance after completing each episode.

The participants in the study conducted by Guillen-Nieto and Aleson-Carbonell were volunteers from the University of Alicante and enrolled in English studies in 2010-2011. These students were polled to determine different variables of the students, including "sex, academic year, level of English, previous training in intercultural communication, and frequency of video game play." The study consisted of a pre and post test, and an observation of the students while playing the game. One hundred and six students completed the pre and post test and out of these students, 50 were randomly sampled to perform the result analysis on.

The learning effectiveness of *It's a Deal!* was determined by the difference in the scores of the pre and post test. The results showed statistically significant

differences in both intercultural knowledge and intercultural awareness and a highly significant difference in intercultural communicative competence. Correlating the scores based on the grouping of the variables of the students suggested only "the variable related to the level of English was significantly negatively correlated," in such a way that the students with lower levels of English learned more than the students with a higher level of English. During the observation of the students, they "seemed to be very enthusiastic about the idea of playing the serious video game." While the students were playing the game, they also "were deeply engaged and immersed in the game to the extent that they forgot about the time, let themselves go, and even burst out laughing occasionally." *It's a Deal!* showed "to be an effective learning tool for the teaching of intercultural communication between Spaniards and Britons in business settings (29)."

Revolution is a multiplayer role playing game based on Colonial America in 1775, specifically Colonial Williamsburg, and was born from an idea to create an online historical simulation for the classroom. The basis for wanting the game to be an online role-playing game was to encourage learning through a social experience and to give a hands-on learning environment rather than memorization through a textbook. The game was designed to take about 40 minutes to play so it would fit into a classroom setting. Revolution was created from a mod version of the game engine Neverwinter Nights and was part of the Education Arcade initiative at MIT’s Media Studies Lab. The game is played by

picking one of seven characters who lived in 18th century colonial America with each character having different aspects of class, race, gender, and political perspectives. Throughout the game, the players interact with each other and other characters built into the game in order to accomplish their individual goals. In doing this, the players were to get an understanding of how it was to live in colonial America prior to the American Revolution, how information flowed differently through the town based on people's status and class, why people of that time made the decisions they made, and how these decisions shaped history (1,3).

Francis employed Revolution in a classroom context at MIT's Teacher Education Lab. He conducted a 3.5 hour workshop with 3 groups of homeschooled students and a group from a local high school. The students in the workshop grasped the game very quickly as it only took 35 minutes for them to become accustomed to the interface. A teacher-led discussion was conducted during the workshop. At times the discussion was "rich and complex" and it was apparent that each student had a different perspective on the events in the game. Francis notes this as a difficulty in that sometimes it failed to give a common frame of reference. This led him to incorporate an exercise of having the students write a diary or record a video of their perspective that was to be shared in the class. Francis argues that in this respect the game can be used to show students that history isn't always straight forward and that "for any one historical period there may be plural or multiple histories." By using this method

of teaching, the students can get an understanding of history that is not possible with textbooks (1).

Karen Schrier from MIT designed an Augmented Reality (AR) game called Reliving the Revolution (RtR) in order to evaluate AR games' potential for teaching 21st century skills. The Partnership for 21st Century Skills describes 9 different categories of skills that "can provide students with conceptual tools and breadth of perspective to contribute the critical dialogue and informed actions necessary to create a stronger world." These 9 different categories include: 1) Information Management Skills, 2) Media Fluency Skills, 3) Communication Skills, 4) Critical Thinking and Problem Solving Skills, 5) Enthusiasm, Creativity, and Curiosity, 6) Consideration of Multiple Perspectives, 7) Teamwork and Collaboration Skills, 8) Self-Direction, Responsibility, and Reflective Learning Skills, 9) Social Global, and Community Awareness.

RtR is set in Lexington, Massachusetts at the site of the Battle of Lexington. The game participants are to use historical information provided by the game to decide who fired the first shot during the events of April 19, 1775. To play the game, the students are grouped into pairs with a GPS enabled PDA and are to explore the actual grounds of the Battle of Lexington. While they walk the grounds, the PDA gives the participants an opportunity to talk to non-playing characters (NPC), inspect game items or real buildings, and provides the students graphical documents or images. The students are to choose one of four actual historical figures of the time, including a slave minuteman soldier, a free

minuteman soldier, a loyalist townsperson, and a regular British soldier. All their interactions throughout the game play are dictated by what role they are playing. Not only are the participants trying to devise who fired the first shot, they also have specific role-related goals to accomplish in order to not overwhelm the players and guide them to through the game. The game is divided into two 30 minute time periods, one before the battle and one after. Following this, the students come together and compare their experiences from the different roles and debate who they think fired the first shot.

Schrier tested RtR on three groups of students, 2 of them being college and graduate students and one group of middle and high school students. She evaluated the tests on each component of the 21st century skills framework. She concluded that the game seemed to encourage information management. The students were to evaluate the information given to them from the NPC's and game items and decide for themselves the appropriate action to take. They had to continually make hypotheses and reorganize their data. The game also supported media fluency skills in that the students had to go from textual information to graphical and even physical information and connect real worlds and virtual worlds. The students were constantly communicating to their partners in order to examine the evidence and sharing information with other groups to complete their objectives. They were also presenting their evidence and theories in the debate that followed the game play and hence the game supported the development of communication skills. RtR gave the students ample opportunity

to use their critical thinking and problem solving skills in order to solve the mystery given the amount of data they received. The open-endedness of the game and the interactivity in the game created enthusiasm in the students and even creativity was seen in their connections of different information presented to them. Their curiosity was sparked by the fact that different groups were getting different information depending on what role they were playing. During game play, the students were interacting with different historical figures, getting their unique perspectives, and during the debate were considering other possibilities. They were “accepting of other opinions and viewpoints” showing that the game gave way to consideration of multiple perspectives. Similarly, teamwork and collaboration skills were seen throughout game play within groups and outside of groups. Because of the open-endedness of the game and the fact that there were no “pre-established game endings,” the students controlled their learning experience. The participants also became aware that textbooks only offer one perspective of history and that history can be told from different viewpoints. From this, Schrier concludes that AR games, if implemented properly, can encourage learning of 21st century skills. Furthermore, the game proved to be “motivating, fun” and provide “engaging environments (4).”

CHAPTER 3

GAME OVERVIEW

The School of Social Work (SSW) professors' requirements were a big part in determining the decisions for the development environment and how the game was going to evolve. This chapter discusses these requirements and the components used in order to achieve them. The next chapter discusses these particular components and how they were implemented them to create Choices and Consequences.

3.1 General Overview

The idea for Choices and Consequences was to allow students to play a weekend and have it be evaluated by professionals as to how risky their choices were and for teenagers to determine how much fun their choices were. The winner of the game is determined by creating a weekend that was the most fun and risk free. The game was to be played in groups so the students could collaborate together, boys and girls, and determine what they would do in their weekend. Also, an option to play the game separately as an individual was needed to encourage experimentation in game play. The game was to be portable and played on a device that all students had access to. All the data generated by the game had to be stored in a central location as well and

accessible to the SSW professors and the Computer Science and Engineering (CSE) department.

The SSW professors had developed scenarios in which the students could play through during their weekend. These scenarios were composed of activities, options, challenges, actions, consequences, and sub-challenges.

- Activities are considered high-order activities that can be chosen to fill up a weekend. The students could choose activities such as going to the movies, playing basketball and so on. Activities also take up a portion of time in your weekend and can cost money.
- Options consisted of lower-order activities. For example, if a student chooses to go to the movies, their options can consist of going with a friend or going with a parent. Options are rated on a scale of 1 to 10 for fun and risk.
- Challenges are problems or issues that occur when a player chooses their activity and option. If the player chose to go to the movies with a friend, a challenge may be presented with the friend asking the player to go smoke a cigarette outside. There can be multiple challenges, or things that can occur, for each option. Only one of these challenges are presented to the player after choosing their option and are picked at random according to a predefined probability set by SSW. Challenges also have a theme associated with them, discussed below.

- Actions are choices the player can choose in response to a challenge. In our example, if the challenge is a friend asking the player to smoke with them, an action such as “Tell your friend you would rather stay inside the movie theater and watch the previews” could be presented as a choice for the player to choose. There are multiple actions that can be chosen in response to a challenge and actions are also ranked in fun and risk. Actions corresponded to one of 9 different topics, discussed below.
- Consequences are the outcome of a chosen action and are considered to be realistic. For example, choosing not to do drugs may result in a consequence of your friends not liking you. There can be multiple consequences to one chosen action, but only one of these consequences are chosen at random according to a predefined probability set by SSW. Consequences also have points associated with them.
- A sub-challenge is similar to a challenge, but a sub-challenge is presented in response to the players chosen action instead of their chosen option. Sub-challenges also result in the player having to choose another action. In this way, we can have multiple nested problems (challenges and sub-challenges) the players can encounter when playing a particular activity/option combination. A sub-challenge may or may not exist for a particular action chosen by a player.

Additional important definitions include theme, topics, points, money, fun, risk and score.

- The SSW professors decided on three themes in which they wanted to address with the students: *Healthy Relationships*, *Conflict Management*, and *Help Seeking and Giving*. Each challenge corresponded to a theme. The themes divided the game into weeks, each week having a different theme. This allowed C&C to address different themes each week.
- The topics included: *Refusal Skills*, *Considering Consequences*, *Handling Emotional Situations*, *Expressing Yourself Clearly*, *Providing Support*, *Setting Boundaries*, *Being in Control*, *Asking for Help*, and *Giving Help*. Each action had a topic associated with it. When points were awarded with the resulting consequence, a portion of those points were given to the particular topic from the chosen action. This allowed for an evaluation of each topic at the end of the weekend.
- Points were awarded are based upon each consequence. These points are separated between bonus/penalty points and topic points. Bonus/penalty points are points given based on an outcome not controlled by the player, such as a friend's reaction. The topic points are determined by what the player has control over, which are their actions. Points were to be used to buy things in order to encourage students to play as many games as possible.
- Money was given to the players as an allowance for the weekend. The players choose what they want to spend their money on, such as going to the movies or the mall. Only activities cost money.

- Each choice (option or action) given to the player is ranked based on risk. The ranking is from 1-10 and determined by professionals. Risk is cumulative throughout the game.
- Each choice (option or action) given to the player is ranked on how fun it is. The ranking is from 1-10 and determined by the players. Fun is also cumulative throughout the game.
- The score of each game is determined by subtracting the risk score from the fun score to determine how much fun and risk-free a weekend is. The score also determines the winner of the game. The student or group with the highest score for their weekend is considered the winner.

This cycle of activity, option, challenge, action, consequence, sub-challenge, action, consequence, and so on, was designed to make the game as complex as possible so as to keep the students engaged and entertained instead of being bored with the same choices or scenarios. In addition to these many combinations, the themes were to be played on a weekly basis; each week the theme would change and therefore the challenges would change each week. The SSW Professors also developed these scenarios for boys and girls because the gender often determined the amount of risk associated with each choice (38).

The game was created to be a multiplayer game in order to encourage a discussion among peers and create an environment where students could collaborate and learn from each other. To encourage teamwork, the players were to be separated into groups of students, each group competing against the other

groups. To encourage discussion among these players, a chat room was to be incorporated into the game. Students would be able to talk about their available choices, what other group members chose to do, and the outcomes that worked best for them. Chats were to be organized in groups where only members of the group could view their chats.

Choices and Consequences was to be played for three weeks by each student for them to experience all 3 themes. During each week, students were allowed to play as many individual games or group games as they could. It was the SSW professors' hope that the students would also play the game at home and outside of school. At the end of each week, the players were to play one game as a group inside the classroom and the score of this game would determine the winner for that week. The game would then be used to facilitate conversation within the classroom of what choices were considered to be the best and how the winners of the week were able to get the high score. This group discussion was intended to get the players to see the parallels in real life decision making. The game was designed to let them experience situations, respond to them, and see the consequences of their actions before these situations occur in real life.

3.2 Conceptual Design

Choices and Consequences was played by the students through an application installed on tablets. This application communicated to a server on the network. This communication was accomplished through HTTP requests and

was the facilitator of group play and chatting between teams. This configuration can be seen in Figure 1. All information sent from the server was sent in XML format.

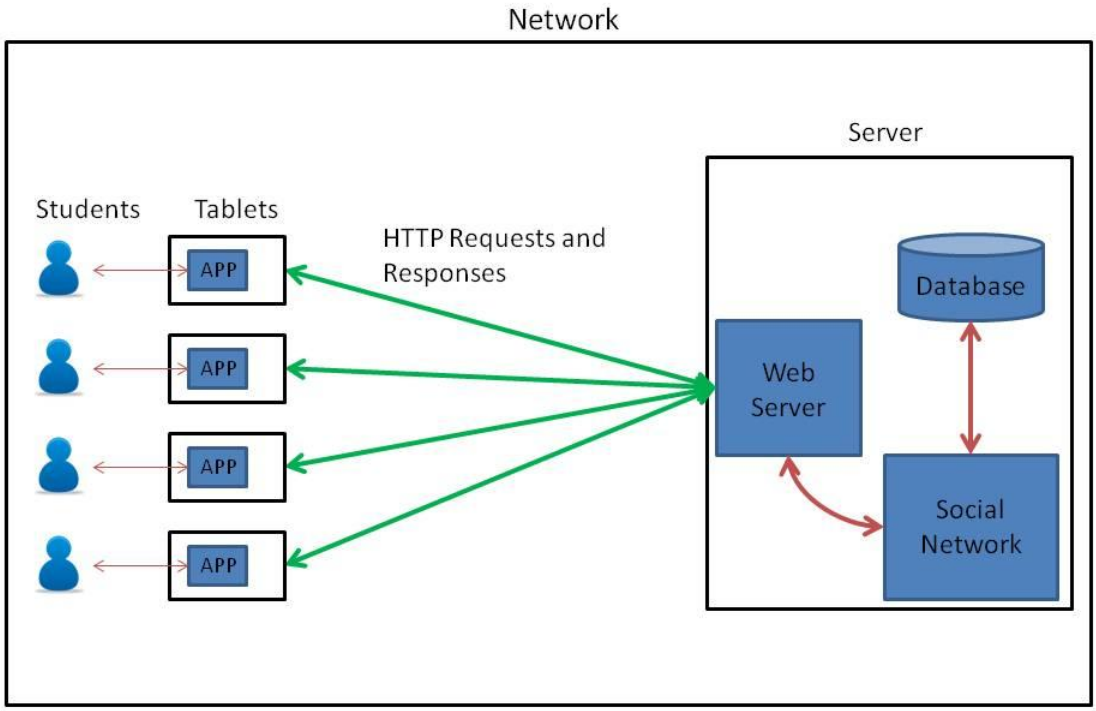

Figure 1. Choices and Consequences Configuration

Each student was given their own tablet in which to play. The server was a web server that ran a social network and a database. The social network enabled the creation of groups and users as well as assigning users to groups. All information pertaining to the students, groups, and games was stored in a database on the server. When requesting this information, the tablets sent HTTP requests to the web server, which forwarded this information to the social

network. The social network then queried the database for this information, returned it to the web server which then returned the information to the tablets. Similarly, when a student chose something to do in their weekend, this information was sent through HTTP requests to the web server, then to the social network, and stored in the database.

While playing within a group, all group member's screens needed to be identical in order for each member to know what was currently happening in their weekend. This was accomplished with the server. All the tablets within the group were continually polling, or asking the server for changes in their weekend. When a change occurred, or a group member made a choice, this choice was sent to the server. Members of the group would only get this information displayed on their screen after polling for changes in the game. There was no communication directly between tablets. Communication occurred only between the tablets and the server.

While playing individually, there was no need for group member's screens to be synchronized as they were not playing the same weekend together. But, while playing individually as well as within a group, the ability to chat was still available. Similarly to playing within a group, chats were sent and received by the server as well.

Because the intended users of this game were pre-teens and teens, the tablet screens had to synchronize relatively quickly being the students didn't tolerate waiting for responses very long. This factor influence the polling

frequency of the group games, which was determined to be 3 seconds. The frequency needed to be short enough to not lose the student's attention, but also not too frequent as to bog down the network. Chat polling occurred every 7 seconds. This was decided upon because chatting did not affect the game play.

3.3 Scalability and Limitations

Creation of groups and users was accomplished with the social network. The number of groups or the number of users was not limited on the social network. In addition, there was no limit as to how many users could be in a particular group. While testing Choices and Consequences, no scalability problems were discovered in terms of using too many players or having too many players in a group. This was not stress tested; the maximum number of tablets in use at a time was 20 with anywhere from 1 group up to 7 groups. But, because there was only one server in use with tablets polling for information at all times, the game is likely to encounter problems as the number of users grows in terms of overloading the server and the network.

The social network also allowed for users to be in more than one group. This, however, was not possible during game play. The students only played within one group. If a user was place in two different groups, the game only considered the user to be in the first group created on the social network. There was no mechanism for choosing which group, if the player was in multiple groups, to play for.

CHAPTER 4

EXPERIMENT

4.1 Setup

In this section, we will describe how we set up our experiment in terms of what technologies were involved and how we came to our decisions regarding programming environment, game platform, server configuration, social network host, and game configurations.

The first decision to be made was to determine how the game was going to be developed and on what device the game was to run on. We decided to develop with a game engine. This decision was determined by the fact that we were building a game and were limited on time, about a semester and summer. Game engines are designed to make coding and game development easier and faster (7). There are many game engines out there and the decision came down to cost, API considerations, complexity, portability, support, documentation, and the success of the game engine. Many popular game engines that were considered were ShiVa, Unity, and Unreal Engine. Development in ShiVa could be done in either C/C++ or Lua (10), Unity could be programmed either in C#, javascript, or Boo (8), and the Unreal Engine was programmed in its own self-created scripting language (37). Each came with its own IDE and could build for multiple devices, including the web. These engines were highly popular but they

were also complex in that a lot of time was needed to be put in to learn how to use the IDE. These three in particular are also 3D engines, something we were not interested in either. There were few others such as Flixel and FlashPunk that were Flash engines with coding in ActionScript. These engines were downloaded and the tutorials were found to be easy to complete. But, being that we were leaning towards either iOS or Android for phones for portability, we decided against Flash. Another option that was explored was the Android SDK. This became quickly apparent that it would not be an option because the emulator was so slow. The game engine that was decided upon was the Corona SDK game engine, which came with its own simulator, a free unlimited trial, coding was done in Lua, and could build to multiple versions of Android and iOS. Corona's website was fully documented with their API and contained many tutorials. The user forums were extremely helpful as well; one of the creators of the SDK returned many of my questions very quickly. The website also posted examples along with free code to download. In addition, Corona was also gaining popularity with the game Bubble Ball. Bubble Ball was the most downloaded application on iOS at the time and was created using Corona by a 14 year old boy (31). Furthering my decision was the time it took to download and create my first "Hello World" application using the SDK. Although the programming was done on a simple text editor, this meant there was no need to learn how to use an IDE. The simulator was easy to use and ran quickly. The simplicity of Corona made it very attractive next to the complexity of the 3D engines mentioned

before. Corona also contained API that supported networking using HTTP requests which was a must since we were developing a multiplayer game. Once Corona was decided up as our game engine, the decision to make the game run on Android became apparent. We wanted the game to be portable and eventually run on a phone. With Android, there were multiple devices available and it was not necessary to break into the operating system to install a third party application. To install an application onto an iOS device, it must come from the AppStore (23). Also, because we did not want to be limited with screen space and, with the newest version of Android 3.0 being released, we decided to develop for Android tablets with the intent of eventually porting C&C to smart phones.

To incorporate the chat room into C&C, we chose to run a social network on a central server controlled by us. The social network was required to run on our own server in order to allow us to have complete control over it. Because the server was to store students' information, it could not be accessible to anyone else. This is the main reason why FaceBook or any other main stream social network was not chosen. We also needed it to allow for creation of groups and remote access, or in our case, the tablets to connect to it to send and receive messages. In reading *makeuseof.com*'s list of top 5 open source social networks, Elgg was described with all of the qualities we were looking for. Elgg is set up using a LAMP (Linux, Apache, Mysql, PHP) configuration and it also won the Best Open-Source Social networking platform for 2008 (32). Also offered with

Elgg is its Web Services which allows for doing “integrations with third-party applications.” Elgg also handles user authentication and allows for creation of groups (34). Elgg’s web services allows methods written in PHP to be exposed, permitting 3rd party applications, or the tablets, to make HTTP requests to the site. This was our main form of communication that took place between the server and the tablets. With this choice, our server configuration was also decided upon: Linux running Apache, PHP and mysql.

The next decision was to decide how to incorporate the scenarios into the game. Because of the tree-like nature of the scenarios, XML format was decided upon. This also allowed for the file to be changed independently from the game code itself. The XML editor, a SSW intern, could make changes to the files without effecting the programming done in the game. The DTD to describe the scenarios is shown in Figure 2.

```
<!ELEMENT week (gender,activity*)>
<!ATTLIST week id ID #REQUIRED>
<!ELEMENT activity (name, description, cost, time, pictureId,
movieId,startTime,endTime,sound,option+)>
<!ATTLIST activity id ID #REQUIRED>
<!ATTLIST activity idRef IDREF #REQUIRED>
<!ELEMENT option (name, description, probability, fun, risk,
movieId,challenge+>
<!ATTLIST option id ID #REQUIRED>
<!ATTLIST option idRef IDREF #REQUIRED>
<!ELEMENT challenge (theme,description, fact,probability,movieId,
action+)>
<!ATTLIST challenge id ID #REQUIRED>
<!ATTLIST challenge idRef IDREF #REQUIRED>
<!ELEMENT action (name, description, fun, risk, topic,probability,
movieId,consequence+, Subchallenge*)>
<!ATTLIST action id ID #REQUIRED>
<!ATTLIST action idRef IDREF #REQUIRED>
<!ELEMENT consequence (description, probability, points, movieId)>
<!ATTLIST consequence id ID #REQUIRED>
<!ATTLIST consequence idRef IDREF #REQUIRED>
<!ELEMENT Subchallenge (description, fact,probability,movieId,
action+)>
<!ATTLIST Subchallenge id ID #REQUIRED>
<!ATTLIST Subchallenge idRef IDREF #REQUIRED>
```

Figure 2. Scenario DTD

There were 2 XML files, one for the boy scenarios and one for the girl scenarios. This was to limit the size of the XML files. Because only one XML file was needed to play a game, and a game was either played as a boy or a girl, there was no need to put both girl and boy scenarios together as one. From the figure, you can see the root element is *week* with child elements consisting of *gender* to describe the gender of the XML file (boy or girl) and multiple *activity* elements. The *activity* elements have their own descriptive child elements, such as *name*, *description*, *cost*, *time*, *pictureId* and so on, and also multiple *option* elements. Like the *activity* elements, *option* elements also have descriptive

elements, and also multiple *challenge* elements. *Challenge* elements, along with their descriptive elements, have multiple *action* elements. *Action* elements have multiple *consequence* elements, along with optional multiple *subchallenge* elements. *Subchallenge* elements have multiple *action* elements and so on. All of the elements *activity*, *option*, *challenge*, *action*, *consequence*, and *subChallenge* have an attribute “id” and “idRef.” These elements are our main parent elements and we will refer to these elements as main elements. Their id’s are unique throughout the document and the idRef’s are to reference their parent’s id, or the previous main element. This allows us to store only the id’s that were chosen by the player or for the player. IdRef’s are purely for identifying where in the XML tree each main element falls, i.e., which options go with which activity and which actions belong to what challenges. These two files, girl.xml and boy.xml**,** are stored on the server. When starting a weekend, the player determines if he/she wants to play a boy game or girl game, and the appropriate file is then downloaded through an HTTP request to the server. We put the files on the server so they could be independently modified without making any programming changes to the game.

The fun scores associated with each option and action were to be determined by the students. We did not want the students to have to go through all of these elements and give a fun ranking, so we decided to add this into the game. When the player chose one of these elements (option or action), they

were asked to rank it on a scale from 1-5. This information was then inserted into the corresponding XML documents with the help of a cronjob.

Other configuration files included weekend.xml. This file determined the length of the weekend during the game and tells the tablet what theme to use. This file was created to make the game as versatile as possible and not hard code this information into the game. It allowed for lengthening or shortening the duration of the weekend without changing any code in the game. And, most importantly, the theme for the week can be changed through this XML file with no need to change the code within the game at all. This file is downloaded from the server with an HTTP request before starting a new weekend. This made it possible to change the theme without requiring an update of the application on the tablets.

4.2 Implementation

In this section we will describe how we implemented all of the components of the experiment in order to fulfill the requirements of the game. In the next chapter we will describe the results of the students playing the game.

The experiment was implement at a local high school in Arlington, Texas. The school is open for at-risk students who, for various reasons, cannot attend a normal high school. The location was close to UTA's campus and SSW already had a good rapport with the school since they had done projects with them before.

The creation of users and groups was done by a SSW intern working at the high school. This intern was able to do this on the social network's website running on the server. For each student participating, he created a user and added them to a group determined by the social workers at the school.

C&C was able to be downloaded on to the tablets by the intern as well. An .apk file was created with Corona SDK and uploaded to the home directory of the web server. The intern could download this file and install it onto the tablets using a web browser.

The Elgg social network, called FunTimes, was hosted inside the high school's network. Corona's API allowed for HTTP requests and Elgg allowed for 3rd party integration through their web services. This is how the main communication took place between the tablets and the server. The tablets made HTTP requests to the server for the girl.xml, boy.xml and weekend.xml files. These files sat in the home directory on the server and were downloaded at the beginning of each game. Elgg's web services were programmed using PHP. In order to utilize Elgg's web services, a *plugin* was created by following one of the tutorials on Elgg's website (35). After creating this plugin, it was possible to add any PHP functions needed. Elgg's web services allowed for these functions to be called as methods from HTTP requests by using the function *expose_function* (36). This function allows for the site admin to specify if the caller has to be authenticated and what parameters are needed to call it. Elgg also organizes and controls the database on its own and therefore dealing directly with the database

was not needed (33). Instead, Elgg has what are called “ElggEntities” which are split into 4 main categories: ElggObjects, ElggUsers, ElggGroups, and ElggSites.

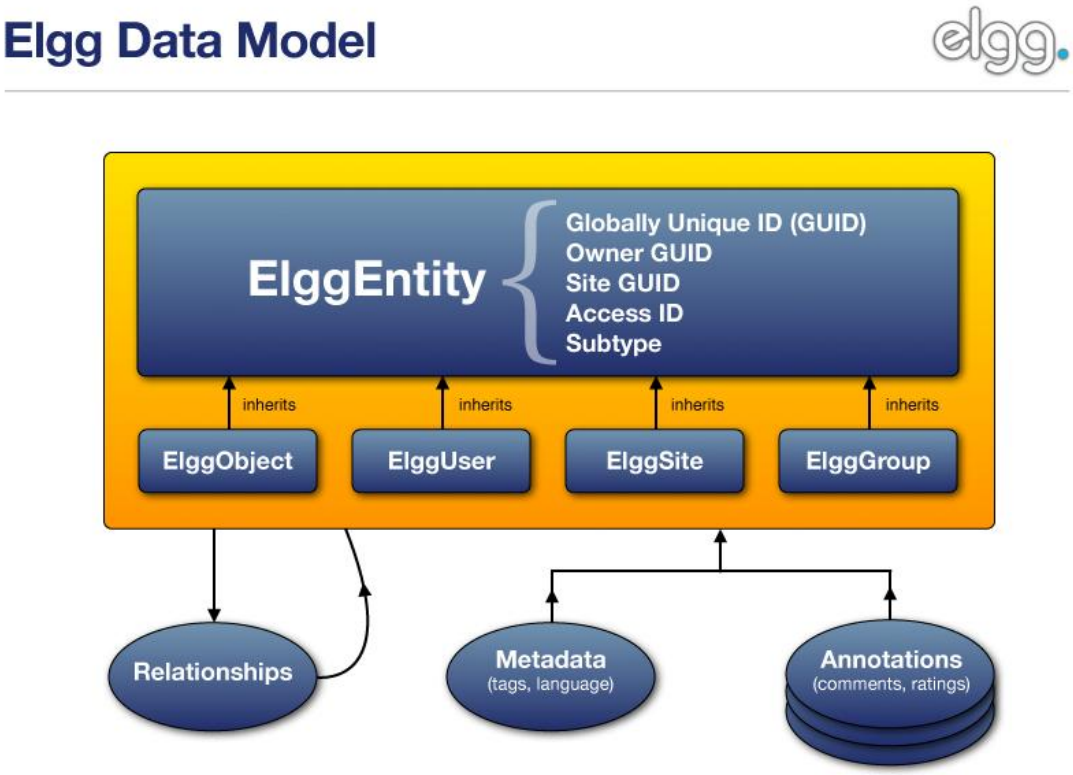

Figure 3. Elgg Data Model (12)

Using Elgg’s entity data model, ElggObjects were created for each weekend that was played. ElggObjects have many properties, including a globally unique identifier (guid) and a subtype. Each game ElggObject in the database was given a subtype of either groupGame or singleGame to distinguish between the two. Also, Elgg allows for creation of your own properties (41). Using this, each game ElggObject was given a theme property and a gender property. In order to give ownership of a game to a group or a user, an ElggRelationship was used. ElggRelationships create a relationship between

different entities. The games were each given an ElggRelationship between either the user or the group, depending on if the game was being played within a group or a single user. All these properties were initialized at the beginning of each game through a method created on FunTimes.

Each weekend has a lot of information associated with it such as points, risk, fun, hours, money, and the string of ids that make up the game play. All of this information was saved and updated continuously as a property of the game ElggObject. During game play, HTTP requests were sent to the methods that were created on FunTimes. Using the parameters supplied to the methods, this information was saved/updated to the corresponding game ElggObject. When a game is completed, the C&C application calls a method on FunTimes and a property of the game ElggObject called *finished* is set to true. A game is determined to be finished by the tablet when all the hours in the schedule have been filled.

In addition to ElggRelationships linking game ElggObjects to users, another ElggObject called ratings was created and linked to users through an ElggRelationship. The ratings ElggObject stores all the ids of elements that the user has rated along with their corresponding ratings.

The C&C application on the tablet consisted of three main screens: the Login screen, the Game board, and the feedback screen. Here we will see each one in detail and discuss their components and functions, along with the flow of the game.

4.2.1 Login Screen

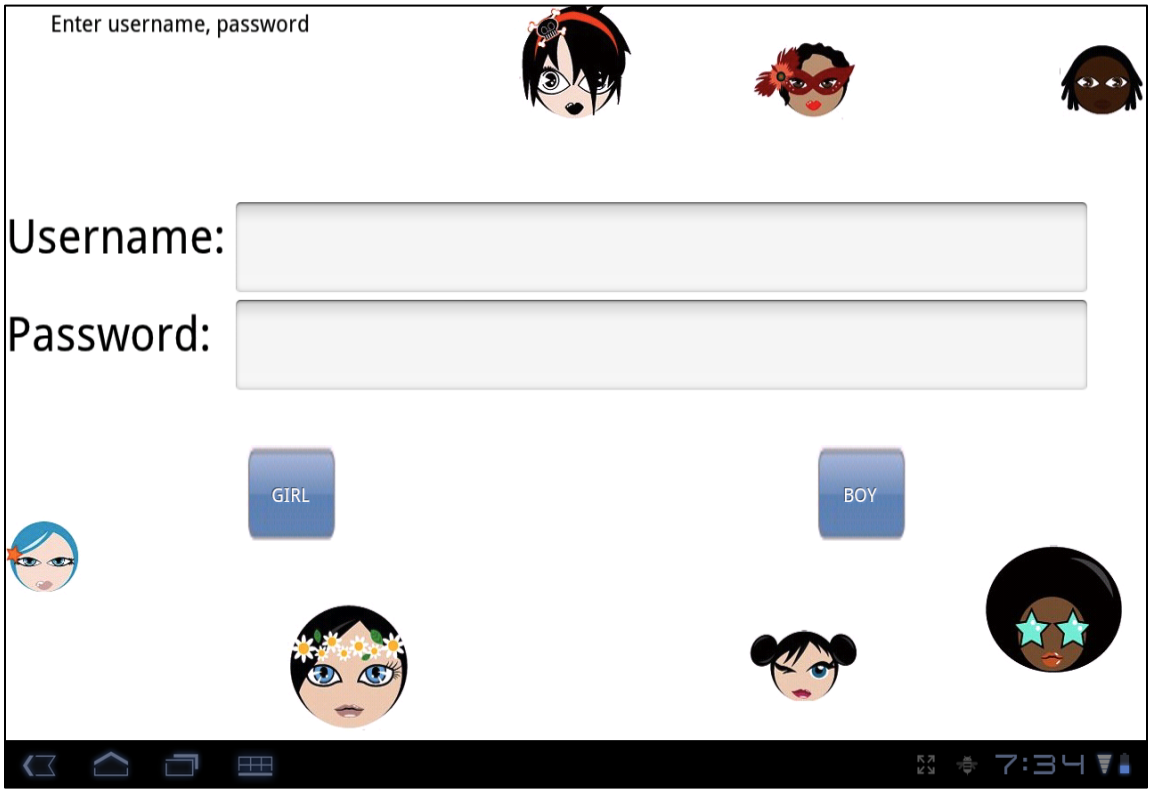

Figure 4. Login Screen

The login screen, shown in Figure 4, consists of two text boxes for the user to type in their username and password. The two buttons “GIRL” and “BOY” are used to log in depending on what kind of game you would like to play. The faces are simple JPEG files.

After the user types in their username and password, to log in they tap either “girl” or “boy.” When this happens the game sends an HTTP request to the server for user authentication. If the user is authenticated, the server sends back a token, otherwise the user is notified that their username/password combination

was incorrect and asked to try again. This token is then passed with every HTTP request to the methods on FunTimes in order to identify the user.

Once the token is received and saved by the tablet, the user is presented with an introduction to the game. The introduction is dependent on what gender the player chose, shown in Figure 5.

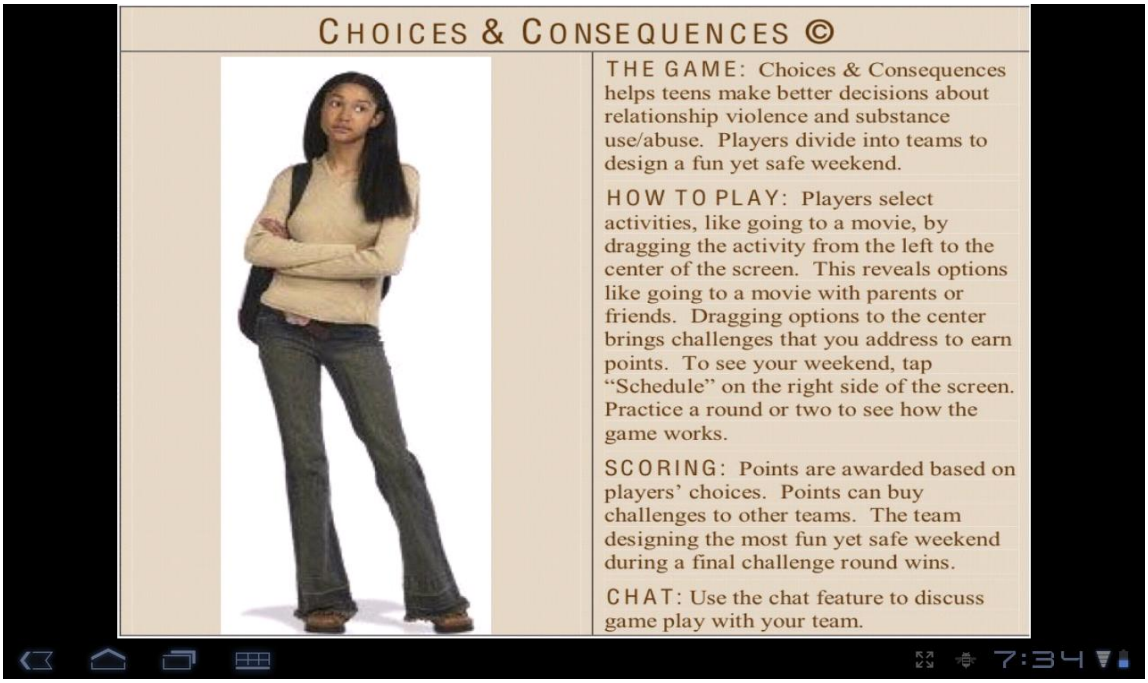

Figure 5. Girl Introduction Picture

To proceed, the user simply taps the introduction picture and then the user must choose if they would like to play on their own or with their group (Figure 6).

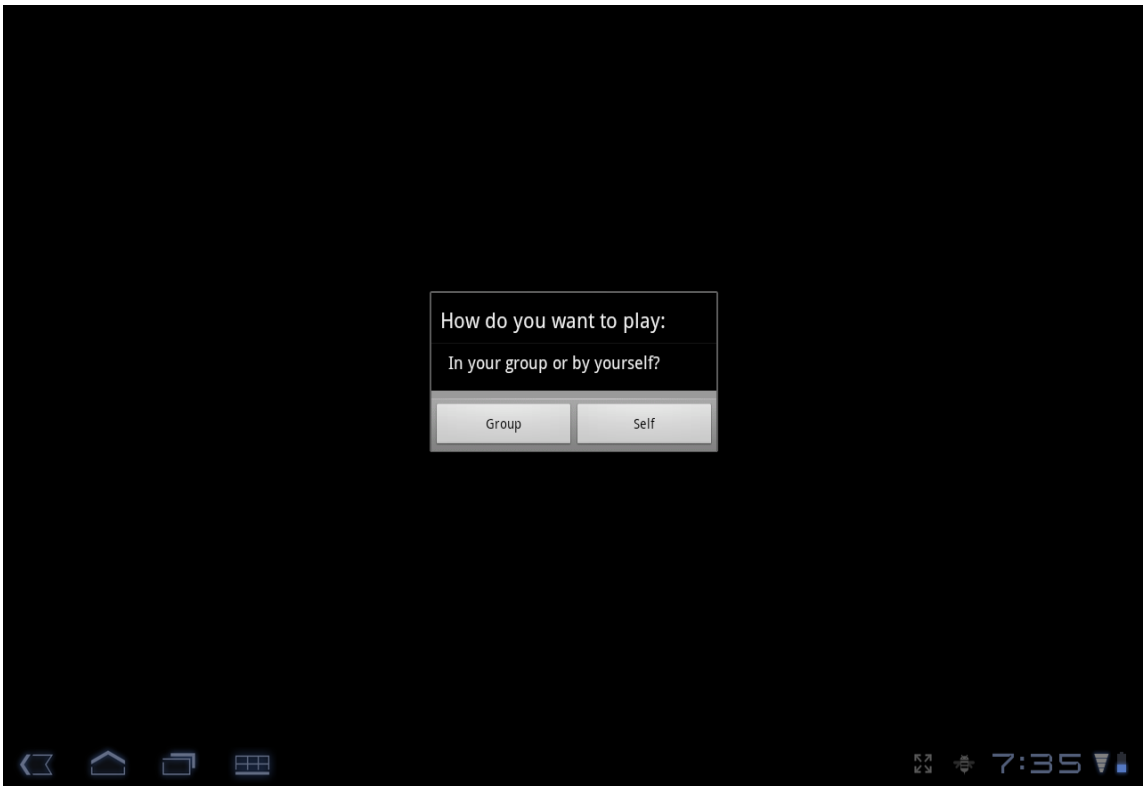

Figure 6. Group or Self Alert Box

Once the player makes this choice, several things happen:

- An HTTP request to the server for the file “weekend.xml” is made. This file tells the game how many days the weekend is played for and how long each day is (in hours). This file also tells the game what theme the game is to be played for.
- An HTTP request to the server for the file “girl.xml” or “boy.xml” is made. Once received, the game parses the information into Lua tables with one table for each of the main elements (activityTable, optionTable, etc). While

parsing, the game uses the theme given to it from the weekend.xml file to determine which challenge elements to save. If the challenge is not needed for the game, i.e. it is the wrong theme, then it is skipped.

- An HTTP request is sent to an exposed method on FunTimes for the ratings made by the user from previous games. The method returns the ratings' ids to the game in XML format. The game parses this information and stores the rated ids into a Lua table. This is used to prevent the user from rating the same element more than once.
- An HTTP request to an exposed method for the current game is made. This method uses the parameters token, gender, theme, game mode (group or solo) to determine if the user has any game objects not marked as finished that fit the criteria (gender/mode/theme). If there is an unfinished game fitting the criteria, an array of id's is returned, otherwise the tablet knows to start a new game.
- An HTTP request to a method on FunTimes is made to retrieve the chat logs belonging to the user's group to be displayed on the message board in the game. These chats are sent to the tablet in XML format.

4.2.2 Game Board

After the tablet has received all this information, it either rebuilds the old game that has not been finished by playing all of the ids given to it from the server, or opening to a blank schedule with nothing played yet. The basic layout of the game board can be seen in Figure 7.

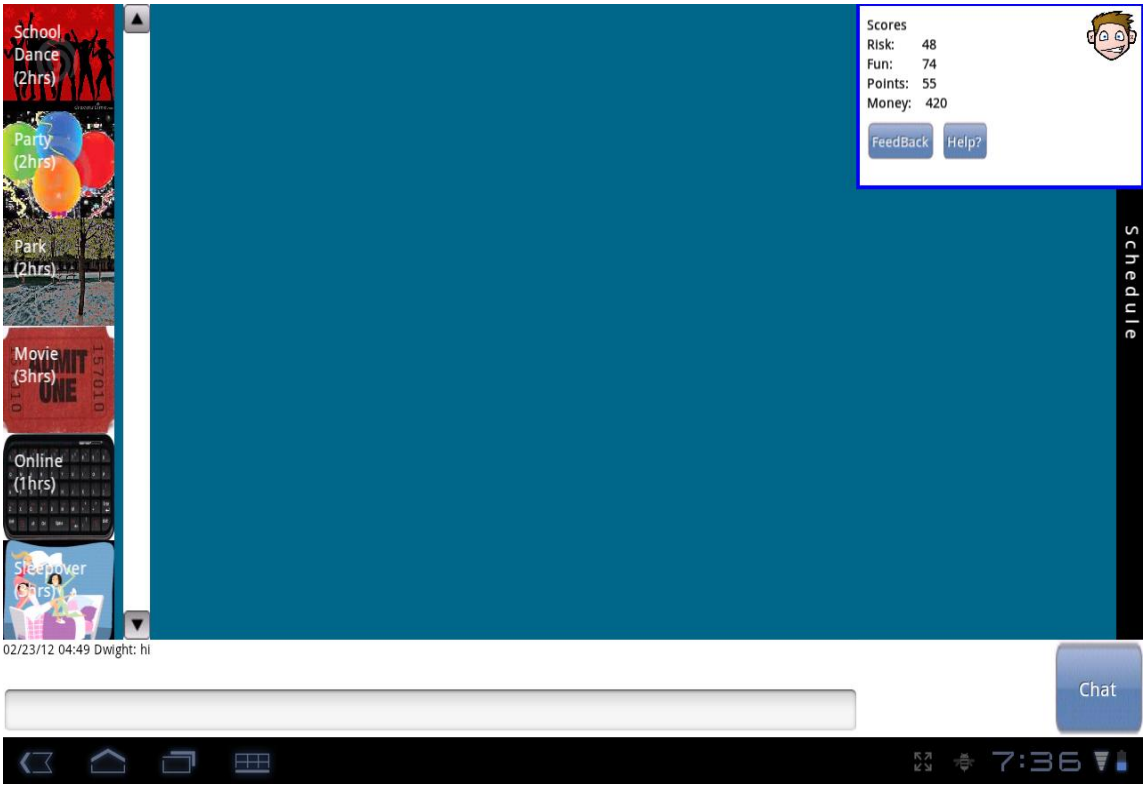

Figure 7. Game Board Showing Activities

The game board consists of buttons on the left hand side. These are the choices that are available to the player at any given time. The buttons are draggable and double-tapping them reveals their full description. To choose a button, or in this case an activity, the user must drag the button to the center of the screen, or over the white line. Tapping the arrows allow for scrolling of the buttons up and down the screen.

The white space at the bottom is reserved for chatting. The top half is the most recent chat posted by the group. The bottom half is for the user's chat input. Clicking here will pop up a keyboard in which you can type a message. To send

the message to the group, the user presses enter and an HTTP request is sent to a method on FunTimes.

The top right is the user's scoreboard. This is where the user can view their current risk score, fun score, the amount of points, and remaining money for the rest of the weekend. Also in the score board are 2 buttons: Feedback and Help. Feedback is a summary of scores for the game, which will be shown and discussed below. Help is a simple help screen describing the components and of the game board and their functions.

On the right, you can see the schedule bar. Tapping on this will reveal the schedule of your weekend (Figure 8). Double-tapping this schedule will make it disappear again.

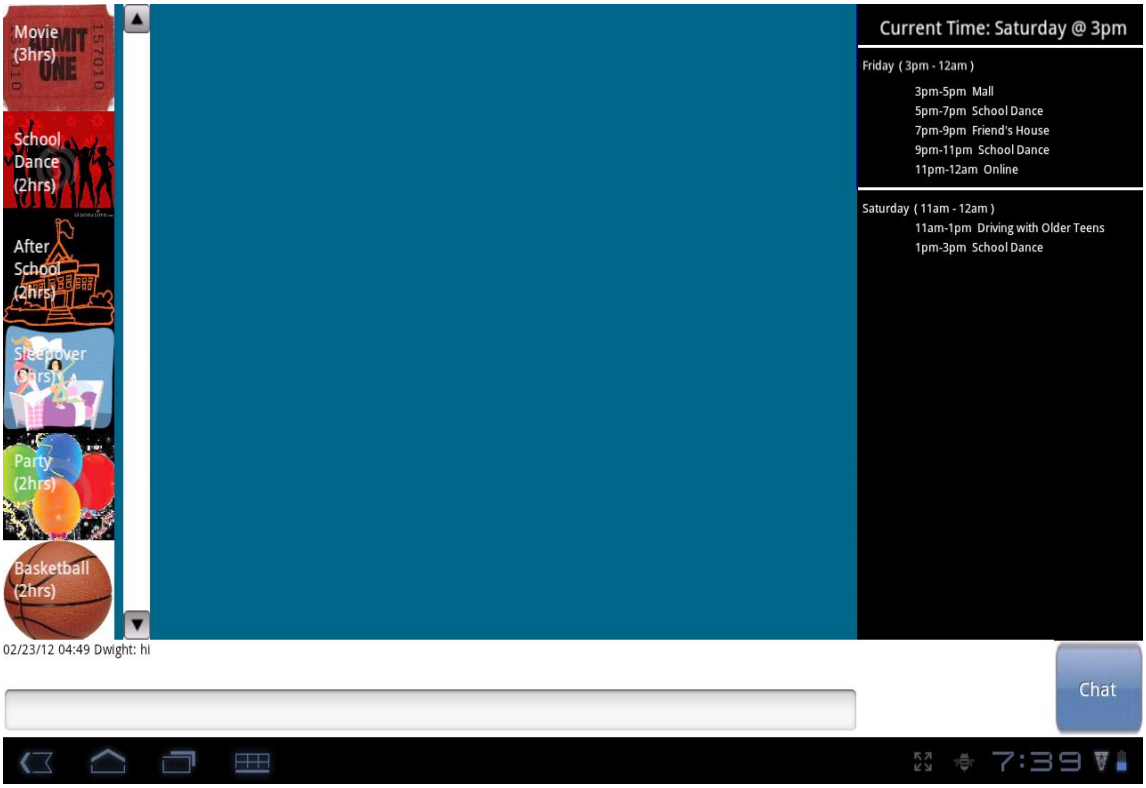

Figure 8. Game Board Displaying the Schedule

The game board also has a Chat button on the bottom right. Tapping on this will bring up the entire message board consisting of all the chats between the user's group (Figure 9).

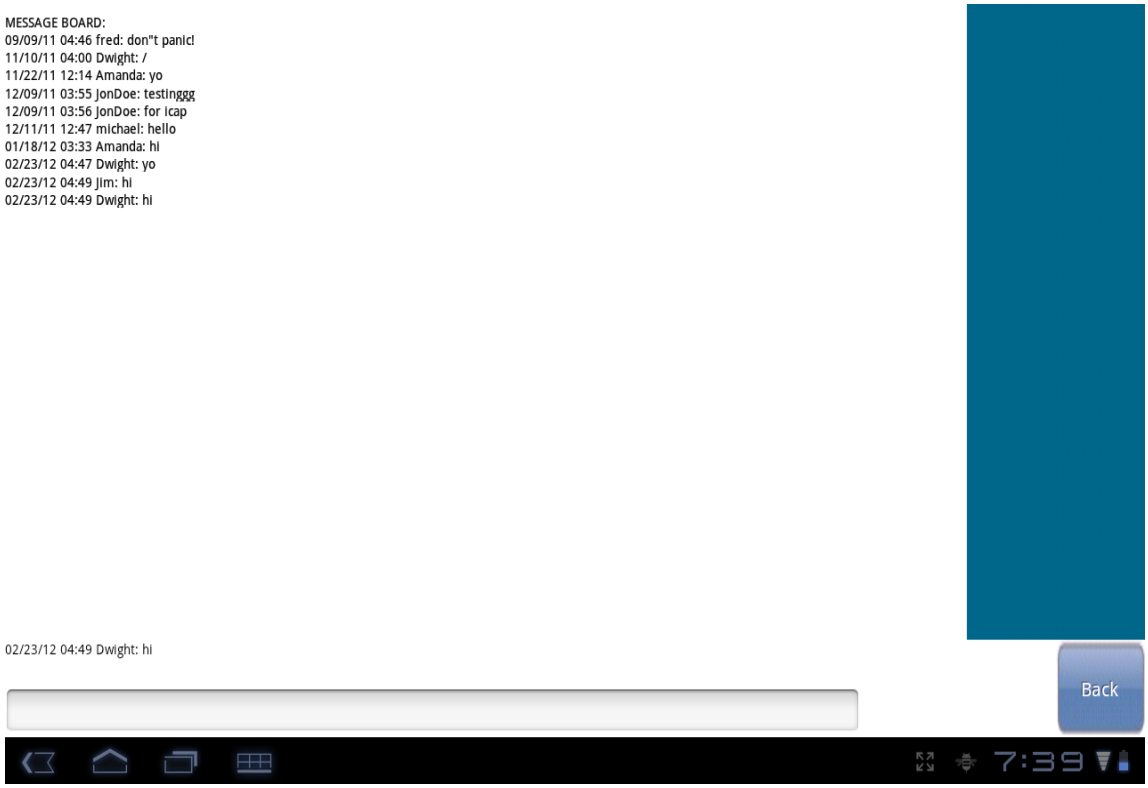

Figure 9. Message Board

The buttons displayed on the left will always change depending on what state in game play the user is in. When it is time to choose an activity, the activities are displayed on the left hand side. Once an activity is chosen, the corresponding options are shown on the left hand side and so on. This is accomplished by using the ids in the XML document. When an activity is chosen, the Lua table containing the options is searched. The game looks to find options where their idRef values correspond to the chosen activity's id. The matches are displayed on the left.

The actions are displayed a bit differently. As shown by the DTD, actions have a probability associated with them. A challenge can have multiple actions

as a response, but only five of these will be chosen. Using the probability associated with each action, the game randomly chooses 5 of these to display.

Challenges and consequences work similarly. There can be multiple challenges for a particular activity/option combination as well as multiple consequences for choosing a certain action. These challenges and consequences have a corresponding probability. Once an option is chosen, the game randomly selects a challenge to display from the Lua challengeTable (Figure 10).

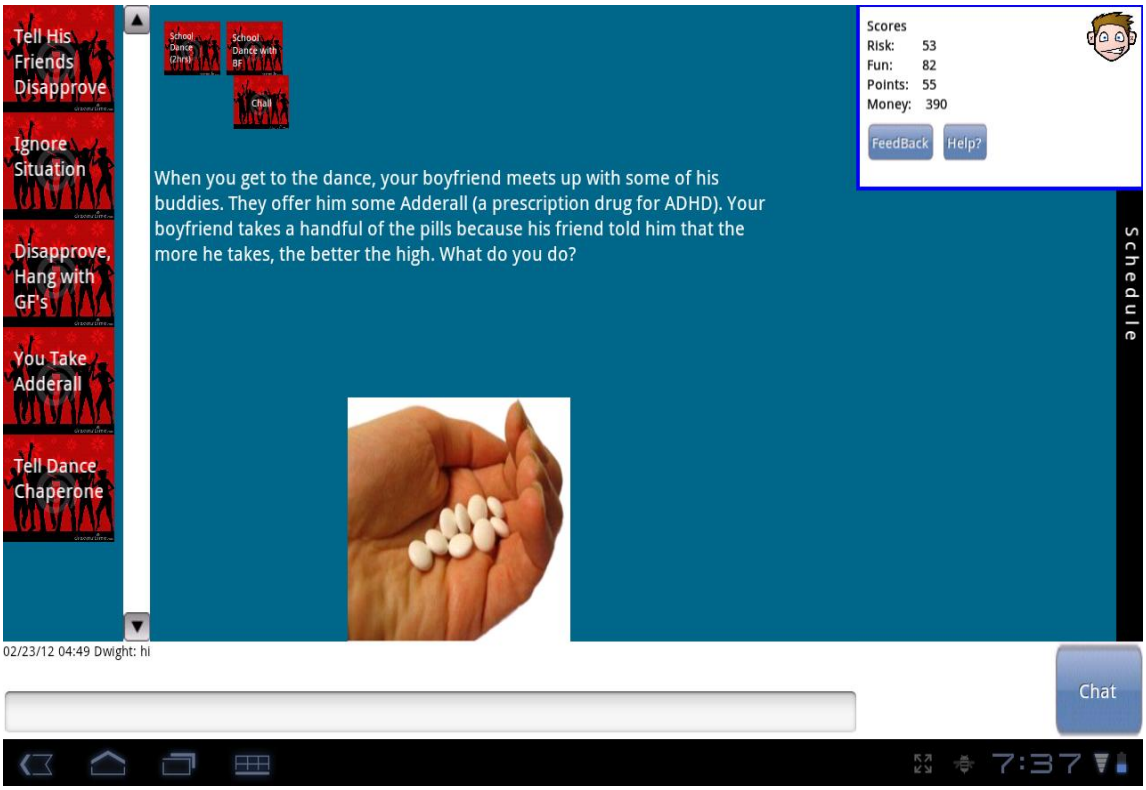

Figure 10. Game Board Displaying a Challenge

And, similarly, one consequence is chosen as well after choosing an action (Figure 11).

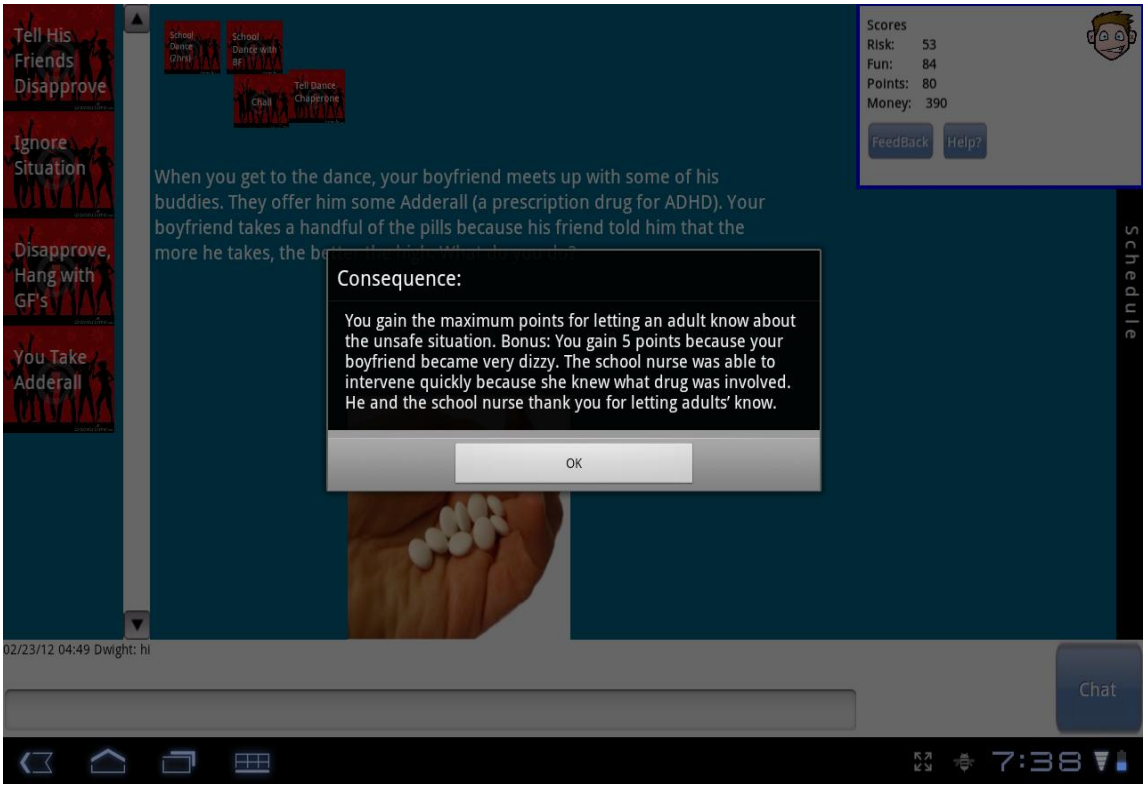

Figure 11. Game Board Displaying Consequence Alert Box

Every time one of these main elements is chosen (activity, option, action) or is chosen randomly by C&C (challenge, consequence) an HTTP request is sent to a method on FunTimes and saved into an array in the database (the property "played" for each game ElggObject). Similarly, every time the fun, risk, points, or money value changes, an HTTP request is sent to a method and the value in the database is updated.

The player rates the options and actions throughout the game for the fun associated with them. This is done only when one of these elements is chosen that the player has not already rated. They are asked to choose a rating on a scale from 1 to 5, then the ratings and their corresponding ids are saved locally in

the Lua table on the tablet and then sent through an HTTP request to a method on FunTimes and saved into an array property of the ElggObject called rate. These ratings are multiplied by 2 to give us a scale from 2-10.

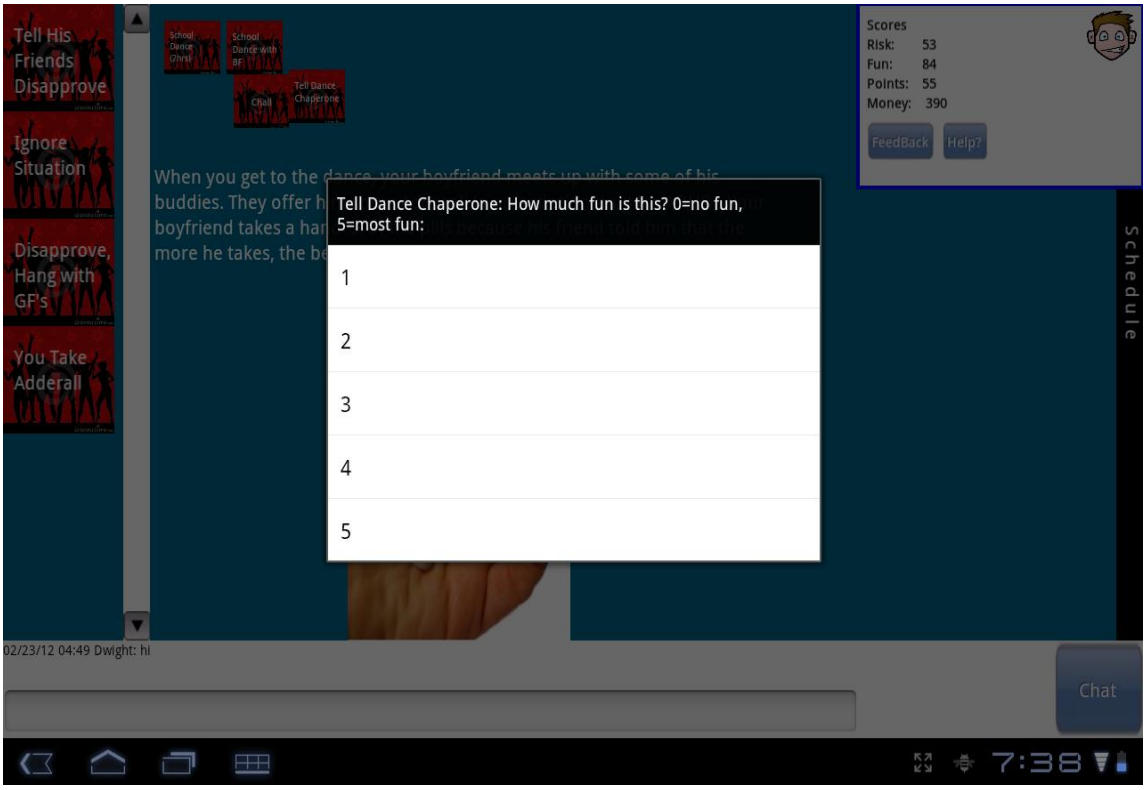

Figure 12. Choices and Consequences Asking For Fun Rating

4.2.3 Feedback Screen

Any time during game play, the user can click on the feedback button on the score board. The feedback screen shows the user's scores as well as the points by topic number. The feedback screen is also automatically shown at the end of each game. The user is then asked if they would like to play again (Figure 13).

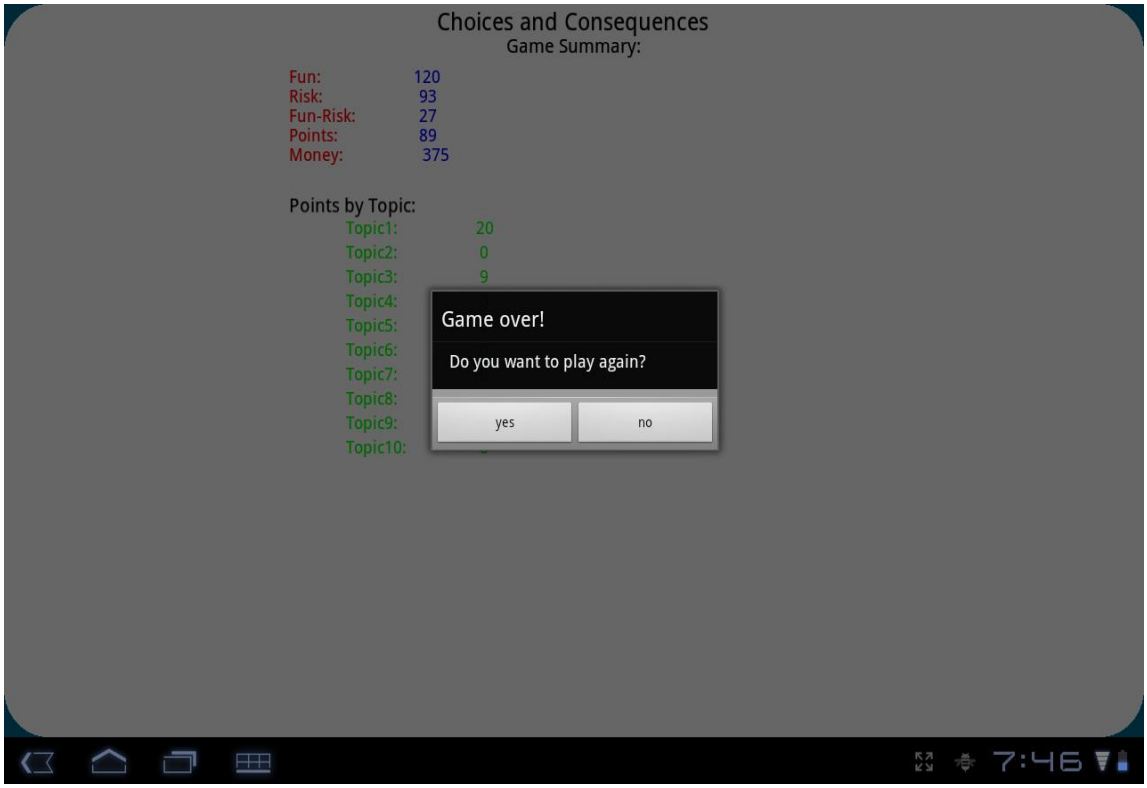

Figure 13. Feedback Page for Game Over

By clicking yes, a new game is started and then the user is directed back to the game board. Clicking no brings the user back to the login screen.

Polling was prevalent throughout the game. It was necessary for the chatting mechanism and group play. Chatting took place during group play and solo play. Chat polling occurred every 7 seconds. Polling during group play was necessary to keep the group members screens current. This occurred every 3 seconds. Group game polling had to occur more often because the game board changed more frequently than did chatting. Because polling took a toll on the battery life and slowed the tablet down, group polling would only start if the user

chose to play in their group. There was no need to poll for the state of the game if the user was playing on their own.

Polling was made possible by timestamps. Elgg keeps two timestamps related to each ElggObject in the database: time_created and time_updated. When the user started a group game, not only did the tablet receive information regarding starting a new game or an old game, but the tablet also received a timestamp. When polling for group play, an HTTP request was sent with the timestamp as a parameter as well to a method on FunTimes. The timestamp was used to determine if the tablet was up to date. If the timestamp was current with the game ElggObject's time_updated timestamp, nothing was returned and the tablet took no action. Otherwise, the tablet received the entire array of ids, along with the current time_updated timestamp, and updated its game board accordingly. Similarly, chat polling sent and received a timestamp and updated the message board only when needed.

The girl and boy XML documents played a huge role in C&C. Each of the main elements contained descriptive child elements that were displayed in C&C. The names on all the buttons came from the child elements *name* for the *activity, option,* and *action* elements. When these buttons are double-tapped, the full description of the choice is displayed. This description comes from the child element *description* for those main elements as well. Each of these buttons are displayed with a JPEG file. This file name is stored in the *activity* child element *movieId*. The *option* and *action* buttons inherit the same picture as its parent's

activity picture. The *consequence* text displayed for each consequence is given by its *description* element. File names for the pictures displayed in the center of the screen are also defined in the girl and boy XML files. Other determining factors such as *fun*, *risk, cost, time,* and *probability* are defined here as well. There were two main reasons for this. One, the game was constantly in the development stage. The scenarios were being revised for spelling and grammar errors as well as adding more content to the scenarios. And, two, we did not want to hard code anything inside game. Anytime an update inside the application took place, it was necessary to use Corona to build the .apk file and download and install the application on all of the tablets. If a spelling mistake was found while playing C&C, the fix required a change in the XML file rather than code . Anytime content needed to be added to the game, adding an additional branch to the XML tree made this possible. With these XML files, it was possible to code the game as general as possible and allow for many changes throughout game play without extensive changes in the code.

CHAPTER 5

RESULTS

In this chapter, we will evaluate games played by the students as well as their use of the chatting mechanism while playing the game. We will look at the scores during game play in both group and solo games as well as the chat logs compiled by the FunTimes. In addition to these analytical results, the SSW researchers compiled verbal feedback from students in a focus group who played the game over a 2 week period.

On average, games that did not span more than one day took about 20 minutes to complete. In total there were 250 games played during the trial (142 solo games and 108 group games). Due to some players and teams either not finishing games or technical difficulty, we could only consider 127 of the 250 games. There were 14 groups in all and there were 40 students who played (1 of which did not complete any games).

In evaluating both solo and group games, we will only compare games played within the same gender and in the same week played by the same player/group. This is due to the nature of the game. Although female and male scenarios are very similar, they were pulled from two separate XML files with different risk scores, being that some scenarios are riskier for females than males and vice-versa. Also, the game changed themes each week, from healthy

relationships, to conflict management, to help seeking and giving, and with one week having no theme at all. These theme changes resulted in different challenges that the players were to encounter and respond to. Any changes to the XML files, additional activities, options, actions, or challenges, and any game enhancements were also implemented between weeks.

To determine how well a player performed, we will look at their score, which consists of their fun score minus their risk score. To determine if the player got better or worse, we compare their score for their first game with one of the last games played within the same gender during the same week. A player with scores that stayed the same resulted from scores that were very similar or less than a 5 point difference.

5.1 Solo Games

Thirty-nine students in all completed at least one solo game. Out of these 39 students, 23 students only played 1 solo game during the testing period. Out of the 16 students remaining students, 15 students completed more than 1 solo game a week. These 15 students are where we can draw our comparisons from. Out of these 15 students:

- 13 students played more than 1 solo game in only 1 week.
    - 6 of these students got better
    - 3 stayed the same
    - 4 got worse.

- 1 student played 2 weeks in which they completed more than 1 solo game.
    - The first week they got worse
    - Second week they got better.
- 1 student played 3 weeks consecutively in which they completed more than 1 solo game.
    - The first week, they played both male and female games with both games getting better.
    - The second week of games got worse.
    - The third week of games got worse.
    - Although this student got worse in the last two weeks, it may be worth noting that their risk score was reduced.

Overall, solo games resulted in 6 students getting better over time, 5 students getting worse over time (including the student who played 3 weeks resulting in getting worse overall), and 3 students scoring the same overtime.

5.2 Group Games

The students were divided into 14 groups in all. Of the 14 groups, 7 groups played only 1 game together. Of the 7 groups that played more than 1 game, only 4 groups played more than one game in one week. These 4 groups give us our reference point as to whether group play got better or not. Of these 4 groups:

- 3 groups played only 1 week of multiple group games

    - 2 of these groups got worse (between 2 games each)
    - 1 group scored roughly the same (between 2 games)
- 1 group participated in 3 weeks in which they played more than 1 group game (Team 1)
    - First week resulted in about the same scores (between 2 games)
    - Second week many games were played, both male and female
        - Male games got better (between 6 games)
        - Female games got better as well (between 6 games)
    - Third week were all male games and got much better (between 5 games)

Overall, group games got worse with 1 group performing better throughout the week, 2 groups getting worse, and 1 team performing about the same.

5.3 Group Games vs. Solo Games

Thirteen students played a solo game in the same week that their group also played a group game. We can compare the student's solo game average to their group's game average in the same week played with the same gender. Of these 13 students:

- 10 students played 1 week in which their group also completed a game
    - 5 students averaged the same score as their group score
    - 3 students averaged better solo
    - 2 students averaged better in a group

- 3 students played more than 1 week in which their group also completed a game
    - 1 student averaged the same as their group their first week, and their group averaged better scores the 2nd and 3rd weeks.
    - 1 student averaged better in their group their first 2 weeks and better on their own their 3rd week
    - 1 student averaged the same as their group their first week, and their group averaged better scores the 2nd week

Overall, more students showed no preference in playing in groups or individually, with 5 students performing the same within their group and on their own. Of the students who were impacted by group play, 4 students performed better in their group overall, and 3 performed better on their own overall.

5.4 Chatting

In evaluating the chatting habits of the students, we want to see if a pattern emerges as to whether games were affected by the amount of chatting going on between students in terms of scoring and even possibly time to complete a game. Also, when students are chatting is of an interest as well. Solo games yielded mixed results in terms of chatting habits and game scores, so we will only look at group games in our analysis.

The effects of chatting during group play were most apparent in Team 1. Team 1 played for three weeks straight and at times chatted frequently and at times not at all. Out of all the teams, Team 1's score was also the most

consistent in their improvement during the weeks they played. When looking at their chat logs, it is apparent that Team 1 chatted more frequently in the beginning of each week and less frequently at the end. In games that did not span more than a day, the time to complete a game gradually decreased from 30 minutes down to 15 in the first week, 20 minutes to 10 in the second week, and as much as 20 minutes to 7 minutes in the third week.

It is hard to infer anything from the other team's chatting habits because they did not play as many games during the week and either did not chat at all or chatted very little. There were instances (Week 5 and Week 9) in which a team played 2 games in one week and the amount of chatting between the players increased and their score decreased. There was also an instance in which a team chatting scored the worst in that week over other teams that did not chat (Week 6).

5.5 Focus Group Analysis

In addition to playing C&C, two focus groups were also held after the students had played the game. The groups were separated between genders. The groups consisted of 11 boys and 13 girls. The focus groups were facilitated by SSW researchers and were taped and transcribed. The researchers conducted the groups following a questionnaire guide in order to address the realism, the ability to learn, and what they liked and disliked about C&C.

Girls found the game to be more realistic than boys. The girls stated that the game put them in situations where they could see themselves in real life. The

boys focus group believed more scenarios were needed in order to make it more realistic.

Both boys and girls liked the concept of the game. They liked being put in situations where they had to think about how to respond. Although they liked the premise of the game, both groups expressed being bored during the game due to its repetitiveness and lack of story line. The scenarios did not go into great depth, and both groups stated this would be needed to make the game more interesting.

Both groups thought the game could be used to prevent risky behaviors in teens. Some thought C&C may even encourage risky behaviors. There were some students that stated they did learn something while playing, such as not to drink something that was poured by someone else and hitting someone is not the only action to take in situations.

Despite some mixed review from the students, overall they preferred C&C over traditional prevention methods (39).

5.6 In Class Observations

During observation of the class while they were playing the game and verbal feedback before starting the class, a few things became apparent. Complaints about the game included that the game was unrealistic in that it did not follow a story line. While playing, the students said they frequently were presented with the same challenge and that the once completing a challenge they did not get to see the outcomes from their choices. There were comments

praising the pictures and graphics in the game. Also, a few students enjoyed the scenarios and activities that they were given the opportunity to choose from.

During game play, there was a lot of verbal communication going on as well. I observed on a few days in which the entire class played as groups. Each group was given a leader, often a teacher or social worker, in which to lead the group's discussion. Before making a choice, one of the students was to read aloud the challenge. They all then discussed what they would personally do and then what they thought a 13 year old would do before finally deciding on the best choice. This sometimes led to a heated conversation between players arguing over what the group should do.

It was also apparent that there were some students who did not care to participate. Because the high school is an alternative school for non-traditional students with high risk behaviors, this was to be expected. Although this did happen, these students seemed to be in the minority.

5.7 Discussion

From these results, we can see that the majority of the student's solo games got better over time (6 better, 5 worse, 3 same). This gives us evidence that the students did learn something through C&C. Although not much can be concluded from their chatting habits, it is clear that they did make use of the function during game play.

Although the majority of the groups got worse over time (1 better, 2 worse, 1 same), we can see that the group which played the most games each week got

better. This group, Team 1, was also shown to have chatted the most out of all the groups as well, with the majority of the chats occurring in the beginning of the week. In addition, the time to complete each game decreased as each week went on. Although this information can lead us to believe that chatting has a negative effect on game play (it increased playing time and decreased scores), it can also be inferred that chatting happened at the beginning of each week when the students were trying to find the best strategy and decreased once the students found what worked best. Further proof of this theory is shown through the amount of time it took to complete a game. It can be said that in the beginning of each week when a new theme was introduced, the students strategized more which led to longer games. As the week went on, the students no longer needed to strategize as often. They knew what worked best and therefore played much faster.

In comparing a student's solo game scores to their group's score during the same week, we can see that overall that playing in a group was either beneficial or had no effect with fewer students playing better on their own (5 having no effect , 4 students played better in a group, and 3 playing better solo). This gives evidence to the fact that playing in a group is better than a student playing individually.

During class observation, it was clear that C&C did facilitate group discussion. The students were very talkative during game play. The focus group,

although expressing some negatives in regard to C&C, did give positive feedback in terms of the scenarios and game concept.

Although the numbers are not significant, it can be concluded that there is evidence to show playing a social multiplayer serious game such as C&C can teach a prevention program. It is not possible to conclude that overtime these students' behavior and way of thinking will change, but evidence suggests that by playing C&C they will be equipped with the knowledge of how to change, or prevent, risky behavior.

CHAPTER 6

CONCLUSIONS AND FUTURE WORK

6.1 Conclusions

This thesis has presented the social, multiplayer, serious game Choices and Consequences which is aimed at reducing the high risk behaviors of youth today. C&C was made possible by the implementation of the game engine Corona SDK and the open source social network Elgg. Choices and Consequences was developed to run on Android's 3.0 operating system and incorporated an Apache web server, a Mysql database and various XML files.

Choices and Consequences has been implemented at an alternative high school in Central Texas. Oral feedback from students gives evidence to suggest the game has a potential to be something that students would enjoy and prefer to play over conventional prevention programs. The effects of chatting while playing the game are not known, but it is apparent that the students made use of the function. In addition, the effect of group play is not known either, but it was apparent that playing within a group enabled group discussion and allowed the class to address multiple topics. Although not statistically significant, analytical results from data collected during game play also suggest that students learned how to make fun choices while also being safe. While they may have learned

how to make better decisions in real life situations, whether they actually apply these concepts and change their behaviors in their lives is not known.

6.2 Future Work

While writing this thesis, another group of students were chosen to play C&C at the same high school. C&C's login screen was redesigned and a main menu was added. From this main menu, an option to go to the game store was included. This store allowed the students to use their points to buy things such as space on the login screen and the main menu. The students could put their team name and their individual names on these screens. This was visible to all the groups playing. These additional features were added to encourage the students to play more games in order to accumulate as many points as possible, as well as promoting camaraderie and competition.

Beyond inspiring teamwork and more game play, future versions of C&C has more issues that can be addressed. The focus group expressed many concerns revolving around making C&C more complex and having a story line. Further research should be dedicated to creating more scenarios and challenges to incorporate into the XML files. Including more sub-challenges will also add to the story line and give the students a better understanding of the results of choosing a risky action. Another consideration would be adding in variables such as the weather or a player's reputation. For instance, allowing for the game to simulate a rainy day in which going to a park is not an option. Things such as allowing the possibility of begin grounded by parents or issues concerning the

players health were brought up during the focus group. Also, giving activities certain times and days in which they are allowed to be chosen is something we wish to incorporate to give the game a better flow.

When SSW created the concept of C&C, the targeted audience was chosen to be pre-teens, or 13 year olds. They wanted to reach this group of kids in order to prevent them from beginning to participate in risky behaviors. It is their belief (SSW) that teens in high school are already participating in behaviors that C&C is trying to prevent. Further, these teens are at a stage where they are not willing to change these behaviors. This alternative high school in which the experiment was conducted, was chosen in order to get feedback from students to determine the validity and realism of the game. The fact that 23 out of 40 students completed only 1 solo game is testament to the fact that this school is not the best place for testing. The students' attendance rates at the school are very inconsistent. Graduation dates are year round and dropout rates are fairly high as well. Because of this, future testing of C&C needs to be implemented in a different school with consistent attendance rates and a larger group of younger students. Further research into the long term effects of playing C&C can then be conducted.

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BIOGRAPHICAL STATEMENT

Amanda Vines was born November 28, 1986 in Arlington, Texas. She received her Bachelor of Science in Mathematics from Northwestern State University of Louisiana in May 2009. In May 2012, she received her Master of Science in Computer Science from the University of Texas at Arlington. Her research interests include mobile applications and serious games.