

ATHABASCA UNIVERSITY

**EDUCATIONAL MASSIVELY MULTIPLAYER ONLINE ROLE
PLAYING GAME FOR TEACHING YOUTH FINANCE**

BY

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ABSTRACT

It has been stated that people need to improve their knowledge of finances and make better choices with their money. Many programs have been created to teach basic finances. These programs target people of all ages from adults all the way down to kindergarten students. The vast majority of opinions on teaching finances state that education begins with children – the younger the better. The goal of this research project is to create a fun to play (massively) multiplayer online role playing game (MMORPG) capable of teaching younger students how to better manage their personal finances. The game will be designed as an educational title with an attempt to balance both the entertainment and educational components. It will be a combination of a game and a simulation. Students will live out a virtual life in a generated game world making financial decisions for their character in an attempt to develop enough wealth to allow that character to retire.

TABLE OF CONTENTS

Chapter I - Introduction.....	11
Motivation.....	11
Goal and Contribution	13
Thesis Organization	14
Chapter II - Financial Literacy Review – Current Programs and Using a Game.	15
Financial Literacy Importance	15
Financial Literacy Programs.....	16
Using a Game to Teach	22
Chapter III - Educational Financial Game.....	29
Game Design	29
System Scope.....	31
Financial transactions.....	33
Game Rules	34
Random Events.....	39
Game timing	40
Game Play.....	43
System Architecture.....	51
Development Process.....	68
Tools Used.....	69

Chapter IV - Evaluation Plan	71
How to measure learning	71
Experiment.....	73
Chapter V - Evaluation and Discussion	75
Experiment Design.....	75
Participants.....	75
Registration Process	76
The Questionnaires	77
The Pre-Test and Post-Test	79
Results	79
Data Collection	80
Validity and Reliability Analysis.....	81
CGAS Questionnaire Reliability and Validity	81
TAM Questionnaire Reliability and Validity.....	85
Usability Questionnaire Reliability and Validity.....	91
Research Model.....	93
Hypotheses	95
Data Analysis	97
Descriptive Statistics.....	98
Independent T-Test for CGAS	100

Independent T-Test for TAM	101
Independent T-Test for Usability	102
Linear Regression Analysis.....	103
Paired Samples T-Test for Pre-test and Post-test.....	105
Final Testing Thoughts	107
Chapter VI - Summary and Future Work	109
Summary.....	109
Future Work	110
References	115
Appendix A - Pre-Test/Post-Test Questions	126
Appendix B - Pre-Test/Post-Test Questions Answer Key	131
Appendix C - Parent Informational letter.....	134
Appendix D - Parental Participation Consent Forms.	137
Appendix E - Questionnaire To Be Completed Before Playing.....	138
Appendix F - Questionnaire To Be Completed After Playing.....	142

LIST OF TABLES

Table 1. Student Physical Fitness Questions.	19
Table 2. Reliability Analysis of CGAS 2011 questionnaire.	82
Table 3. Factors to be investigated by the CGAS questionnaire.	83
Table 4. Validity Analysis of CGAS Questionnaire.	84
Table 5. Final Valid and Reliable CGAS Questionnaire.....	84
Table 6. Reliability for Questionnaire Part 2 (TAM) components.	86
Table 7. Item assignments in TAM questionnaire.....	87
Table 8. Revised Item Assignments in TAM Questionnaire.....	88
Table 9. Revision #2 of items in TAM questionnaire.....	89
Table 10. Final Reliability for Questionnaire Part 2 (TAM) components.	90
Table 11. Final Revision of items in TAM questionnaire.	91
Table 12. Reliability for Questionnaire Part 2 (Usability) components.	91
Table 13. Validity Analysis for Usability Questionnaire.....	92
Table 14. Final Reliability for Questionnaire Part 2 (Usability) components.	93
Table 15. Final Validity Analysis for Usability Questionnaire.	93
Table 16. Hypotheses of the Technology Acceptance Model.....	95
Table 17. Hypotheses of the revised CGAS (2011) model.	96
Table 18. Hypotheses of systems usability.....	96
Table 19. Hypotheses of the moderators introduced.	96
Table 20. Main research hypothesis.....	97
Table 21. Comparison of game playing time.	98
Table 22. Sample sizes of gender and time spent playing games.....	99

Table 23. Descriptive statistical data of all constructs.	99
Table 24. Gender Differences on factors of CGAS.....	100
Table 25. Game Experience Difference on Factors of CGAS.....	100
Table 26. Gender differences on the TAM constructs.	101
Table 27. Gaming differences on TAM constructs.....	102
Table 28. Gender difference on the Usability constructs.	102
Table 29. Game experience on the usability constructs.	102
Table 30. Effect of CGAS and TAM Factors on Intention to Play the Game.....	103
Table 31. Effects of TAM and Usability factors on Perceived Usefulness.	104
Table 32. Descriptive Statistics of Pre-Test and Post-test results.	105
Table 33. Paired Samples Test Result for the Pre-Test and Post-Test.	105
Table 34. Hypotheses and Analysis results.....	106

LIST OF FIGURES

Figure 1: Game/Simulation Relationship [55]	30
Figure 2. Avatar arriving in the game for the first time.	47
Figure 3. Avatar at the apartment rental office.....	47
Figure 4. Avatar arranging restaurant deliveries.....	48
Figure 5. Avatar at a restaurant buying a meal.....	48
Figure 6. An avatar arranging grocery deliveries.....	48
Figure 7. AN avatar buying furniture.....	48
Figure 8. Avatar at the bank, opening an account.	49
Figure 9. Avatar enrolling in a diploma program a a school.....	49
Figure 10. Applying for a job.....	49
Figure 11. Avatar looking at the retirement home.....	50
Figure 12. Game main web page.	52
Figure 13. Teacher options.....	53
Figure 14. Student options.	53
Figure 15. Teacher registration form.	54
Figure 16. Successful teacher registration message.....	54
Figure 17. Verification email sent to the teacher.....	55
Figure 18. Teacher login screen.....	55
Figure 19. Teacher dashboard.	56
Figure 20. Teacher changing personal information.	56
Figure 21. Teacher changing their password.....	56
Figure 22. Add class dialog.	57

Figure 23. Teachers class listing (for modify, other dialogs are similar).	57
Figure 24. Add student to class list.....	58
Figure 25. Add student to class screen.	58
Figure 26. List of students in class.	59
Figure 27. Modify student names.	59
Figure 28. Delete student accounts.....	60
Figure 29. First page – real name and class identifier.	60
Figure 30. Second page - password.....	61
Figure 31. Third page - Email address.	61
Figure 32. Fourth page – avatar name and gender.....	62
Figure 33. Final page - success message.....	62
Figure 34. Verification email sent to student.....	62
Figure 35. Student login screen.....	63
Figure 36. Students dashboard (new player).....	63
Figure 37. Take pre-test screen.....	64
Figure 38. Changing student information.....	65
Figure 39. Changing student's password.....	65
Figure 40. Getting the game software.	65
Figure 41. Detailed install instruction screen (partial view).....	66
Figure 42. View last test results screen.	66
Figure 43. Login screen for game software.	67
Figure 44. Interacting with game interface items.	67
Figure 45. Controls and displays of financially related information.....	68

Figure 46. Macro view of proposed research model..... 94

Figure 47. Micro view of proposed research model..... 95

CHAPTER I

Introduction

Motivation

In 2009, Ben Bernanke, chairman of the Federal Reserve in the United States stated that Americans need to improve their knowledge of finances and make better choices with their money [10]. This education is needed due to the changing financial landscape. Thirty years ago all a person needed to know was how to balance a checking account and maintain a savings account. Today there are many more financial services, products and providers a person must be familiar with. When a person lacks the appropriate financial knowledge they are susceptible to making poor choices in selecting products and services. This results in consumers placing themselves in poor financial condition. If properly educated the same person may make better financial decisions. This leads to better consumers who are able to save and invest in their own future [23].

The vast majority of opinions on teaching finances state that education begins with children – the younger the better [51][3][41][47][57][60]. A child is much more willing and able to learn new concepts. In addition, a person's financial affairs have as much in common with attitudes and behaviors as they do with practical skills [50]. Starting to teach children early instills the proper attitudes and behavior which will allow them to be successful later in life. When these children become adults they are better able to handle money effectively [51] and have better financial habits [57] so they are more likely to be financially successful.

Children are first exposed to financial matters through their parents. A child will often follow in their parents footsteps, making the same financial decisions. If the parents are not properly educated, the children will learn the same habits. In order to properly teach children about finances their parents must be money wise [45]. Another problem with teaching children about money is that it is often treated as a taboo subject [15][57]. Parents need to educate their children on the importance of money and finances otherwise their children grow to adulthood with poor attitudes and skills on personal finances.

While the vast majority of opinion agrees that parents are the first to teach their children, there is disagreement on how it should be done. Some parents believe an allowance is just given without any need to perform tasks [51][3][10], while others specify that it should be paid for doing household chores [41][45][57]. Other parents require their children to save part of their allowance (in a bank account, a jar, etc) [51][3][41], while for others saving is optional [57]. Still more parents put the child in charge of their own spending, not assisting with the child purchasing items unless they can afford it with their allowance [45][47]. Other parents will chip in to help on certain occasions [51][3][10].

While giving an allowance exposes a child to money and purchasing, the question of whether it scales well to financial knowledge at an older age must be asked. Their allowance is used for discretionary items only. Required items such as food, clothing, shelter, etc are still provided by their parents. The requirement to save may not be fully understood either. Short term savings (two or three weeks allowance to buy a

toy) is one concept, but long term savings for a home down-payment or retirement are another.

Goal and Contribution

The goal is to create a fun to play (massively) multiplayer online role playing game (MMORPG) capable of teaching younger students how to better manage their personal finances. The game will stress personal finances, but will show how a poor decision can have a negative effect others in the game as well as how a wise financial decision can make the game better for other players.

The High School Financial Planning Program ® (HSFPP) [13] lists particular topics necessary for proper financial education. These topics also appear in the Dollars with Sense program offered by Junior Achievement¹. Some of the items specified in these programs (listed below) will be used in the game:

- Career selection and earning potential;
- Using credit properly;
- Protecting assets through risk management (Insurance);

While some of these topics will be used in the game, the game itself will be targeted at a younger audience. In the study of students in grade 6-8 [36] it is noted that the students in grade 6 experienced a higher level of improvement over students in grades 7 and 8. As a result, some of these concepts will need to be simplified in such a way that the grade 6 students can understand them, yet they still reach the desired outcome.

¹ <http://www.jacan.org/programs.cfm?itemid=7316&smocid=17>

Thesis Organization

Chapter two will discuss the research and evaluation done on financial concepts taught at various stages, from adults down through preschool students. It will also look at why using a MMORPG would be a good approach for teaching finances. Chapter three will discuss how the game is to be designed, financial topics included and a description of how the game would be played. Chapter four will focus on how the game is implemented and the experiment to be done to verify it is both fun to play and educational. Chapter five will report on the evaluation of the game. Chapter six will provide conclusions, recommendations for further work and improvements to the game.

CHAPTER II

Financial Literacy Review – Current Programs and Using a Game

Financial Literacy Importance

In recent years the financial landscape has changed dramatically. There are a multitude of mortgage options and mutual funds to choose from. Savings and borrowing options are becoming so complex that even a person with financial knowledge may require the use of financial calculators or spreadsheets. These consumers often are making financial decisions without any assistance and often do not receive any feedback on the value of the products they purchase [8]. Financial decisions are further complicated as the world is in the midst of a global recession. Food and fuel prices are increasing, straining a person's financial well being. Mortgage foreclosures are on the increase as are personal bankruptcies along with tightening credit and declining savings [42]. The result is consumers are making bad financial decisions. They do not plan properly for retirement, borrow money at higher interest rates and do not have the ability to acquire assets [8].

Several studies prove that a lack of financial literacy contributes to poor financial decisions. In a study in 2005, a short questionnaire was given to students and adults. This questionnaire contained topics on personal finance and economics. Of the adults who took the questionnaire, an average mark of C was obtained. Students fared much worse with a mark of F [34].

Saving for the future is an area that is frequently not given enough importance. In a study conducted in 2005, only 68.5% of high school students had a savings account [35]. In another study in 1999, less than half of students in senior high and college

regularly saved money and only half admitted saving was important [1]. Many households do not have the required financial knowledge to make longer term and retirement investment financial decisions [34].

Much of the problem is knowledge perception. While many children and adults are making poor financial decisions they do not realize they are doing so. In a German study conducted in 2003, 80% of the participants had confidence in the financial decisions they made. However, when given a test on financial concepts, only 42% of the participants answered the questions correctly [34]. Overconfidence in their abilities is creating a knowledge gap. Instead of seeking assistance from financial professionals, many choose to go it on their own, and continue to make poor financial decisions [34].

Financial Literacy Programs

Much of the problem with a lack of ability is an absence of appropriate training. In the United States only a small number of states encourage or require finances to be integrated into core subjects in schools. Thirty-eight states have personal finance standards, but they are not enforced in 15 of those states. Only 15 states require students to take a course on economics while 7 require a course on personal finance [30]. Canada is in a similar situation as the United States with some financial literacy programs in place; however more needs to be done. The Standing Senate Committee on Banking, Trade and Commerce stated in 2006 that a model curriculum should be created that provides education on financial matters [46].

Many European countries show a lack of consistency in financial education. In a 2007 survey, 154 financial literacy skills were identified as being taught in the European

Union countries with the majority of them found in the UK, Germany, Austria, Netherlands and France [25].

Financial literacy can also be affected by exposure to financial institutions. In Japan it is common for younger children to lack knowledge of financial institutions since they are not exposed to them at an early age. In South Africa this knowledge can vary by location. It is quite common for children living in rural areas to be much less knowledgeable about financial institutions since there are so few of them [25].

Not all countries teach finances. In New Zealand financial education is not required at all. While some subjects do have educational components they are not structured properly, so the education received is more by chance than planning [19].

While there is currently a lack of training programs, there is a realization that there is a problem. Many countries have been and still are making strides to improve financial education at all levels from adults to kindergarten students. In the United States, government as well as the private and public sectors have been working to increase the number of programs available [20]. Canada has developed the Financial Consumer Agency of Canada (FCAC) which is responsible to oversee consumer education on financial matters. In 2007 the Canadian Government committed \$3 million to the FCAC to help them improve financial literacy [46]. In Australia, the Australian Securities and Investments Commission (ASIC) completed a survey of financial literacy in secondary schools and compared these results with the US, UK and New Zealand. The intent was to understand current financial literacy education levels and create proposals for adding the necessary programs to the regular school curriculum [25]. In Hong Kong a private organization has created the Financial Literacy Training program

[25]. Research at the international level has also begun. In 2003, the Organization for Economic Co-operation and Development (OECD) began the Financial Education project for all its member countries. This program had two main purposes; to determine the need for financial education and develop the principles to improve financial literacy education [25].

In 2000, a study on how to deliver financial programs to adults in the United States was done [56]. This study highlighted a delivery problem – adults are more difficult to reach. Several delivery methods were proposed including seminars, pamphlets/books, newspaper/TV/radio and the web [56]. What this report fails to indicate is many of those taking the financial programs are already in trouble financially. These programs would be reactive as opposed to proactive. It would likely be better to deliver the financial programs before the adults are making financial decisions and signing financial contracts [35].

In Australia in 2005 a program was devised for parents and their children. Parents took part in the EvenStart financial Literacy program while their children took the Making Cents program in school. The parents program was reactive as it was attempting to teach parents how to manage finances even though many were already in financial trouble. The Making Cents program for children is designed to be proactive – to teach children about financial matters before they start making large financial decisions. At the completion of the program it was deemed beneficial for both parents in children. Some parents did develop financial literacy and were able to pass this knowledge on to their children. These parents also noted that their children learned from the Making Cents program. While this program could be considered a success, it was

too late for many of the adults since much of their financial problems were already in place. They would be able to make wiser decisions in the future, but were forced to live with the poor decisions they had already made. Targeting people at a younger age has the benefit allowing the person to make wise financial decisions early.

Financial literacy programs are typically not targeted at college level students. Many people do not go to college, and those that do are not required to take personal finance courses [38]. In a study done from 2004-2005, a series of questions was asked of 1,891 college students to determine their financial fitness. The questions asked are listed in the table below.

Financial Management Practices
I avoid writing bad checks or ones with insufficient funds.
I pay my rent/mortgage and other living expenses (i.e., phone and utilities) on time each month.
I pay my credit card bills on time each month and am almost never late.
I avoid maxing out or going over the limit on my credit cards.
I avoid spending more money than I have.
I have little or no difficulty managing my money.
I pay my credit card bills in full each month to avoid interest charges.
I balance my checkbook each month.
I have a weekly (or monthly) budget that I follow.
I regularly set aside money each month for savings.

Table 1. Student Physical Fitness Questions.

Students rated their ability based on a scale of 1-5 (where 1=always and 5=never). All submissions were tabulated and an overall score based on all the questions was tabulated to answer the question ‘How financially fit are college students?’. Most college students stated that their financial literacy was obtained from their parents, yet they only scored 2.2 out of 5.0 [12]. While students generally paid bills on time and did not write bad cheques, they also tended not to save money every month, balance their cheque book regularly or have a budget. Clearly these students need further financial literacy training.

Most financial literacy programs are targeted at the high school level. There are a few reasons for this thinking. High School students are on the verge becoming adults, so they need the education to help make proper choices with regards to insurance, credit cards and student loans. Another reason is that high school is the last opportunity for society to mandate financial education. One such program is the High School Financial Programming Program® (HSFPP). This program teaches higher level financial skills including creating a financial plan; a personal budget; savings and investing; handling credit; using financial services; insurance; and career choice and lifestyle. While learning these individual topics a variety of related skills are also taught. Although this program has been offered in high schools for the last several years, there are two studies from 2009 that question its effectiveness. Both studies indicate that students were no more financially literate than those who did not take the finance course. They question the effectiveness of further high school financial education [38][39]. The ineffectiveness of financial literacy programs may be linked to motivation [39]. These high school students have poor attitudes and behaviors towards financial literacy and do not see its importance, so they are not motivated to learn it [37].

The Youth Financial Literacy Trial Program was designed and delivered to junior high school students (grades 7 and 8) in Melbourne, Australia during the 2005 school year. This literacy program focused on teaching the students the financial aspects of mobile phones and credit cards. While somewhat limited, the program was successful.

While enrolled in the HSFPP, high school students learned various higher level financial skills based on their individual needs. While the program does target students individually, there is some concern expressed that students are not motivated to learn

the material. This may be a result of the students having difficulty recognizing the importance of the lessons on their financial future. Students may believe that the topics covered are not relevant in high school, causing them to have difficulty applying the lessons to their lives. Students enrolled in the Youth Financial Literacy Trial Program could apply the material so they were motivated to learn it. Of the 104 participants in the program, 68.6% already had a mobile phone. Participants were able to relate the use of mobile phones and credit cards to their lives and understood how making these types of financial decisions would affect them [53].

Another pre-high school program was delivered to 10 Chicago area middle schools in 2005-2006. This program consisted of students in years 6, 7 and 8 that watched a play regarding basic finance concepts. The students were tested on basic financial knowledge both before and after watching this play to determine if any new knowledge was acquired. The results showed that students in grade 6 clearly had higher learning than those in grades 7 and 8. While all grades did show some improvement, this study tends to indicate that teaching children at a younger age is better [36].

Preschool children and children in kindergarten to grade 3 represent special challenges. When trying to teach these younger children about finances, other considerations must be taken into account. The ability to understand numbers, basic arithmetic, the ability to read, etc. are all factors. Also, children of this age have difficulty understanding cause-and-effect relationships. They may also understand subtopics but have difficulty putting these subtopics together into higher level concepts. In general, this age group does not have any standardized programs. There are many programs

available, but they come from a variety of sources and are targeted at a variety of ages [25]. What is important is that they are exposed to simple financial concepts like coins, allowance, purchasing, etc. from their parents. This early exposure can help develop positive attitudes and behaviors.

In general, the best time to teach financial literacy seems to be in or near grade 6. Students in this grade are highly motivated to learn financial literacy as a study shows [36]. In addition they require the skills necessary to learn the material and have generally not started making large financial decisions, so it is early enough in their life they can use the education to enhance their financial future. Students before this grade generally do not have the knowledge necessary nor can they relate to the lessons to be learned and applied to their own future. Students in higher grades and high school do not seem to benefit from financial training as the studies show. Waiting until adulthood is simply too late. By the time the financial literacy programs are taken the financial damage has been done.

Using a Game to Teach

Most games are in some way educational, even if they have not been originally designed to be. When played by children, games can introduce new concepts or reinforce existing ones. Consider a deck of cards. There are literally thousands of card games that can be played. In most card games the player needs to know basic matching skills to match card denominations or suits; card denominations are often added together, requiring math skills. Often cards must be counted and matched, requiring counting [62][11], matching [22][52] and more complex mathematical skills [9][11].

Playing a game of Chess requires higher level thinking and problem solving skills. The potential movements of the various pieces are complex, requiring memorization and critical analysis. To win at Chess the player must think logically, have problem solving and critical thinking skills to conceptualize the game many moves in advance [18].

Games like Monopoly introduce a multitude of rules that must be followed, plus introduce the players to basic financial concepts like receiving a salary, paying bills and rent, collecting rent, plus many others. Monopoly also has a social aspect. Players are required to deal with others playing the game, often in a competitive environment.

There are many more examples of games that can teach like Scrabble for words and spelling, hopscotch that teaches physical coordination, etc. The list goes on and on.

Games become instructional when some aspects are designed for training purposes [44]. ShadowBox is a non-digital game that uses computer technology for teaching words and meanings. In this game, children (ages 7-12) use blocks that contain radio frequency identifier (RFID) chips. These blocks are placed inside the 'Shadowbox' which picks up the information on the RFID chips. The purpose of the game is for the child to place the name of an object (a block containing a word) and a block with its matching picture. If done correctly the child is rewarded with a short video and audio clip. If not done correctly the Shadowbox prompts them to try again. The purpose is to teach students to match words with the objects that they describe [54].

Edubingo is a digital game designed to teach math. The game is played in a classroom environment (the study was performed in a grade 4 class) with multiple students participating. Each student receives a wireless tablet upon which the game

runs. For each play of the game, all students' bingo boards contain the same answers to a series of mathematical questions that will be asked. The student can choose to randomly assign an answer in each bingo square, or they can place answers in the squares themselves. As a result each student's board is likely to be different from other students playing the game. Once the boards are set up the student clicks a button indicating they are ready to play. Once all students have clicked they are ready the game begins. A series of math questions appear on the tablet, one at a time. Each student answers the same question, attempting to locate the answer somewhere on their bingo board. A time limit of 30 seconds per question is enforced to ensure the game keeps moving. If a student determines the answer and locates it on the bingo board they click on that bingo square. Once a student has chosen an answer the next question is presented to all players. If no player selects the answer within the 30 second time limit, it is discarded and the next question is asked. Like bingo, the intent is to create a vertical, horizontal or diagonal line. If the game determines that a particular student is close to a bingo (creating a line) it broadcast a message to all the other students. Once a student has answered enough math questions correctly and gets a line, the system broadcasts BINGO to all other players [5].

Some commercially available digital games are also used in an educational capacity. These games include Age of Empires which is used to teach Social Science and Mathematics [24] and Civilization 3 which teaches history [40].

Farmtasia is a digital game designed to simulate managing a farm. Players are responsible for their farm and compete against three other players (farmers) in a virtual world. The players must produce farm products in both quantity and quality while taking

a wealth of other considerations into account (biology, government, economics, technology, production systems, and natural environment). The game is designed to be as near to real life as possible so students learn from their actions and to foster challenges, curiosity, control, fantasy, competition and cooperation to build students motivation [6].

The U.S. Military uses a MMORPG in order to save lives. The game teaches its forces to deal with improvised explosive devices (IEDs), a new and very common danger in today's world. In particular, the game is meant to create a cultural awareness and teach the local language; introduce high-order thinking in order to analyze, synthesize and evaluate situations, think properly and deal with what information they have, not guess; and be flexible and adapt to a constantly evolving adversary [44].

Regardless of the outcome of the games, from teaching a 7 year old to match a word to a picture with ShadowBox to the armed forces personnel trained to deal with an IED, all of these games have been successful in their primary objective – teaching the learner.

The research done has determined the following attributes of games. They are fun, motivating players to continue playing. They require players to understand not only the games features, but may require understanding related concepts outside the limits of the game in order to win. Games require the players to problem solve to progress through game levels, increasing problem solving skills. Players can try things over and over again in a game, allowing them to construct their own ideas and relationships as a result of their actions. Games introduce socialization, allowing players to work together or against each other, promoting competition and cooperation. Players are also able to

assume virtual identities in the game. By playing with multiple identities they can see several different perspectives and learn more about the potential and limitations of those identities [27].

Many types of games (role playing, simulation, puzzles, etc) allow the student to reflect and learn from their actions [27]. Massively Multi-User Online Games (MMOGs) are very highly social environments. These games normally require players to interact not only with the game environment, but also with other players and computer generated characters. They interact to complete tasks either by themselves or in collaboration with others and help build social and communication skills [61]. Students have their own ways of learning. These methods do not always match planned teaching mechanisms used by educators. When playing a game, students can be more spontaneous, performing actions which help them learn more effectively. Also, students can proceed at a pace that is more comfortable for them. This will result in the student being more engaged and challenged in learning [21].

Another advantage to using games, other than their ability to teach, is their wide acceptance by today's students. During the last several years, playing digital games has become a favorite pastime with people of many ages. Currently in the United States the game playing population age ranges from 10 to 34 with the majority of game players between 14 and 19 years of age [65]. While not all students play video games, a good portion of them do. In general, most boys either play or have played a digital game of some sort. While the number of girls playing digital games is not as high, the last several years have seen an increase in numbers to the point where they are almost the same [17]. The students themselves enjoy playing games, even if it is for an educational

purpose. The biggest determining factor for learning using a game is that the game is useful, easy to use and provides good learning opportunities [2].

With the increase in game play, an interest has been developing in the use of online computer games for educational purposes [26][27][29][43]. In one study, researchers looked at the educational, likeability and usability of the game VR-ENGAGE. This is an entertainment/educational 3D game meant to teach geography. The study does conclude that usability is a concern, usually with players that have limited gaming experience. It also states that these types of games, if properly created can compete with purely educational titles [59]. In an elementary school in Turkey, 1240 students were exposed to a 3 dimensional (3D) game called Global Village to learn world geography. The results of the study were positive from both the students and parents perspectives. Students enjoyed playing the game both at school and home. Parents were happy to see children using some of their spare time following educational pursuits instead of purely entertainment [58].

In today's learning culture games are better able to meet student's interests and habits. They are effective because they have students performing actions instead of listening to explanations; motivate students to be successful and allow them to be satisfied when they are; allow the student to use a multitude of learning styles; reinforce skill mastery; and provide an interactive decision making context [31]. Games can also support multi-sensory, active, experiential, problem based learning; activate knowledge learned previously in order to advance in the game; provide immediate feedback on their actions when testing hypothesis; provide for self-assessment through game scores

and advancing through game levels; and promote social environments through a community of users [48].

Using a game to teach grade 6 students should be successful for a variety of reasons. First, grade 6 students have been shown to hold the most promise in learning financial literacy. They are motivated to learn the material and seem to show the most improvement in knowledge of other groups tested. Combining this education with a game leverages the benefits of game play. Games are fun and motivational which encourages the student to continue playing. It allows the student to problem solve in a way that makes sense for them, and allows them to see the outcome of their decisions. These decisions are done in a safe environment – if a poor decision is made the only thing affected is the players character. The student can learn from this mistake and try something new should the same situation occur again. Students are already playing games. Introducing a fun to play yet educational game that will help them develop good financial habits will benefit their future.

CHAPTER III

Educational Financial Game

Game Design

In a study completed in 2008 it was determined that most commercial digital games are entertainment based; educational aspects are not considered [59]. In a survey in November of 2011 it does not seem to have changed much. According to the Nintendo web site, there were 3,418 games available for Wii, Nintendo 3DS and Nintendo DS. Of these titles only 44 or approximately 1.3% were considered educational titles. Xbox was far less with 5 of 1368 titles (only .4%) of their games being educational. The Playstation platforms are lowest. Of the 3474 games available for the various platforms, only 3 of them (or less than .1%) are considered educational. Much of this has to do with marketability. Edutainment games (those designed to be both entertaining and educational) tend to focus on the educational components and leave the entertainment component as a secondary. This often results in much of the game play being taken away from the player. As a result, game buyers tend to avoid these types of games [16]. Educational games strike a balance between the entertainment and education components. They require players to use strategies, test hypothesis, problem solve and use higher order thinking skills [49].

A digital game can also be written as a simulation. Most entertainment and educational games have some components in common with a true simulation. The similarities are that they are artificially constructed, competitive, and follow a set of rules within a particular context. The difference is that a simulation attempts to accurately represent something real [64]. The result is the player experiences a lack of control

within a simulation. Since it is attempting to simulate the real world, the player is bound by the real world environment [14].

A relationship between games and simulations is highlighted in the following diagram:

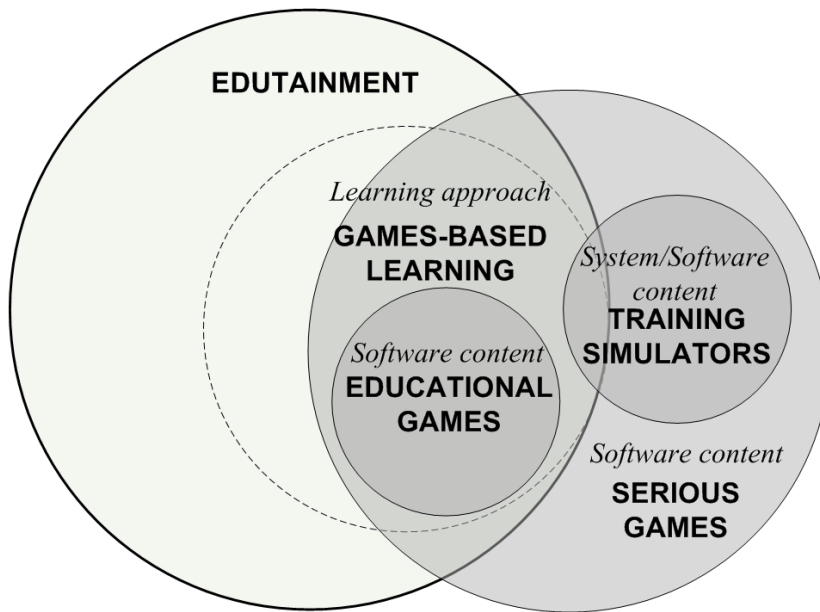


Figure 1: Game/Simulation Relationship [55]

Games are a competitive activity set in an artificially constructed context. These games have rules and constraints that must be followed to reach a certain goal. Simulations are similar; the difference is they try to accurately represent the real world [64]. As can be seen by the diagram above, these games and simulations can be combined together to form a simulation game.

The game is designed as an educational title with an attempt to balance both the entertainment and educational components. It is similar to a game in that it is developed in an artificially constructed world. It is a simulation in that it tries to simulate the real financial situations a student will eventually find themselves in. Like both a game and a

simulation there are rules and constraints that must be followed, plus there is a goal to be reached to 'win' the game.

System Scope

The game attempts to teach basic financial concepts in a fun way. While playing the game in a constructed world, it simulates real financial conditions that the player may eventually experience in their actual lives.

The possibilities for the types of financial transactions a player may encounter can vary greatly, depending on their geographic location and socio-economic class. It would be extremely difficult to develop the game with all possible financial transactions in all geographic locations for all classes of potential students. As a result, the first release of the game will have a fairly tight scope. The financial transactions to be encountered will be based on what a typical middle-class Canadian student might encounter in their life time. Those playing the game will be considered to be average Canadian grade 6 students. The game will not handle disabled students. It is also designed around the student's avatar reaching age 65 with enough to retire comfortably. While not all students would consider this success, this is the target for the first release.

In order to allow the game to be developed within strict time constraints, several other scope decisions needed to be made, as highlighted below:

All players have a basic high school education. Advanced education is available by attending a college or university. These institutions offer generic degrees, not degrees for a particular field of study. Obtaining a degree allows a player's avatar to apply for any job requiring that degree. Degrees available include a diploma, bachelor, masters and PhD. A student may only have one degree, the highest one earned.

There are three classes of jobs, unskilled, skilled and professional. There are no specific job types in either class. Unskilled jobs require no special training. All players can get this type of job. Skilled jobs require basic training (diploma, bachelor) or must have a certain level of work experience at the unskilled job level. Unskilled and skilled jobs will offer on-the-job-experience promotions. Once the required amount of experience has been obtained a player can have their avatar apply for a higher paying position. Professional jobs require advanced education (Masters, PHD). Players require advanced education for these types of jobs, experience does not count.

There are three banks in the virtual world, all offering different interest rates. Banks may offer different interest rates depending on the funds involved in a particular transaction.

There are two institutions providing credit cards. One institution will give a card to almost anyone but charges higher interest rates. The other is much more selective, but charges much lower rates.

There are 3 classes of apartments. Low income apartments are the cheapest and easiest to get into. Townhomes are average grade apartments that are more difficult to get into. Garden apartments are the fanciest, most expensive and most difficult to get. Players must put down a damage deposit equal to half the monthly rent.

There are 3 types of homes, bungalow, two storey and mansion. Bungalows are cheapest to own (\$240,000), two stories next at \$502,000 with mansions the most expensive at \$718,200. Minimum down payment in cash is 5%.

There are no particular 'illnesses' a player gets, they just get sick. Each time they become sick a number of day's ill will be assigned (from one to 7). When sick they are confined to the hospital. If a player allows their avatar to starve they become sick and are sent to the hospital for 9 days. If they over feed the avatar and it becomes obese the avatar is sent to the hospital for 8 days. No catastrophic illnesses will occur in the first release.

When a player gets into legal trouble they receive a generic fine. The amount increases with each fine. The base fine is \$25. The maximum fine is \$300. This amount must be paid with their next pay. If they don't pay they wind up in jail. While a player's character is in jail they cannot work, so lose income. Number of days confinement will increase each time. The first offense results in a single day in jail. Subsequent incarcerations increase by 2 days up to a maximum of 9 days. No major crimes are defined in the first release, only not paying fines on time.

Financial transactions

The financial transactions a player needs to guide their avatar through are as follows:

- Buying items. These items can be paid for with cash, savings accounts or credit cards.
- Opening an account at a bank. It might be a savings account, loan or mortgage.
- Opening an account at a credit institution. This gives the player's avatar a credit card.
- Deposit money to a savings account. This may be short or long term savings.
- Withdrawal cash from an account. This may be a savings account or credit card.

- Hide/Take Cash. Hiding cash away for safekeeping.
- Rent: Obtain an apartment to live in. Rent payments must be made.
- Buy a house: Purchase a home. Specify the mortgage particulars they player wants to live with (term, down payment).
- Sell a house: Can result in a profit when house is sold for more than is owed or a loss if it is sold for less.
- Buy Insurance: Protect personal property with insurance.
- Cancel Insurance: Cancels an insurance policy, removing protection.
- Get Degree: Improve the avatars education. There is a cost involved, but there are also benefits.
- Drop Degree: Drop out of school and get partial tuition refund.
- Get a job: Receive a pay cheque for daily living expenses.
- Quit Job: Give up a job and the pay cheque.
- Buy Food: Keep the avatar fed and watered. Food and drinks cost.
- Restaurant Delivery: Arrange home delivery. Costs more than buying individual meals, but is more convenient.
- Order Groceries: Have groceries delivered to the avatars home. Cheapest and easiest way to keep the avatar fed properly, but still costs.

Game Rules

In order to simulate a real world with financial constraints, several rules will be put in place.

1. All players begin the game at age 18 with \$1,000.

2. Every player requires some sort of job. This job will provide income needed to live.
(Each player can only have a single job.)
3. Players can quit a job at anytime. While unemployed they live off their personal savings until they get another job.
4. Not having enough money to live on results in illness.
5. Illness results in the inability to go to work, resulting in a loss of income. While ill, the player is confined to the hospital.
6. Legal troubles are fines charged to the player. Fines must be paid with the player's next pay. If not paid they are placed in jail and cannot go to work (resulting in a loss of pay).
7. A players extra funds can be handled in 3 ways, by the student carrying it around, hiding it or placing it in a bank.
8. Players do not need to make use of a bank. If they don't then everything they purchase is by cash.
9. Any player can be robbed or lose all the cash they are carrying.
10. Some jobs will pay a wage, others a salary. A wage is a certain amount of money earned per hour. With a wage the more you work the more you make (a regular work week is 35 hours, players can work up to 45 if desired). A salary is the amount paid bi-weekly. With a salary you always make the same regardless of the hours worked.
(Overtime will not be implemented)
11. Students need to borrow money to go to school (unless they have enough cash or savings). Government loans will not be implemented, nor will students have the financial resources initially to go to school without financial help.

12. The higher a player's education, the more a player can earn.
13. If the player does not have a higher education, then on the job experience can be used to get promotions and increased salary/wages. Jobs the player can apply for will be posted. If they are successful in getting the job their job title and salary increase.
14. A player can only spend money they have, unless they have some sort of credit. Attempting to purchase an item without the necessary funds results in the purchase failing.
15. A student can borrow money by getting a personal loan or mortgage from a bank. They must be applied for and can be refused by the bank. If the player is in arrears in any payment a loan is automatically refused. When applying for a personal loan or a mortgage the player's avatar must have a job. Getting a loan or mortgage depends on how much the player is currently in debt (total debt service ratio). This will be calculated by total income divided by total liabilities. Different institutions will use different ratios ranging from 30-50%. In addition, a random factor will also be considered that allows the financial institutions loan officer to grant or deny based on the institutions financial guidelines and their instincts. This will be implemented by generating a random number to represent the officers 'instinct'. This number will be used to determine if the loan is acceptable or not. A 'Student Loan' is also available. This type of loan is easier to obtain. The player's avatar must not be in arrears on a payment and the loan officer must approve the loan. When obtaining a student loan the bank does not look at whether the player's avatar has a job or at their total debt service ratio.

16. Credit Cards are available from Credit Lending agencies. They must also be applied for and can be refused. Getting a credit card depends on how much the player is currently in debt (total debt service ratio). This will be calculated by total income divided to total liabilities. Different institutions will use different ratios. It will be much easier to get a credit card as debt service ratios will be higher, ranging from 40-60%. The players avatar must have a job and they cannot be in arrears on any payments. In addition, a random factor will also be considered that allows the financial institutions loan officer to grant or deny based on the institutions financial guidelines and their instincts. This will be implemented by generating a random number to represent the officers 'instinct'. This number will be used to determine if the loan is acceptable or not. (Bank credit cards and accounts will not be implemented in the first release of the game.)
17. Personal loans, mortgages and credit cards are subject to interest charges.
18. Personal loans are for larger items like cars and furniture. The item is used as collateral against the loan. If the player misses a few payments then overdue interest will be charged. If too many payments (3 payments) are missed then the item is repossessed by the lending institution. Interest rates are typically somewhere between mortgage and credit rates. Payments are fixed over a specified term, but can be paid back early if desired.
19. Student loans are intended for paying tuition fees, although there is nothing in the game that enforces it. These funds can be used at the players discretion.
20. Credit cards are for any type of purchase. No collateral is needed. If a player misses a payment then overdue interest will be charged. If too many payments are missed

(3) then the lending institution can repossess anything owned by that player to pay off the amount owing. Interest rates are high. There is a minimum payment required (3% or \$50 whatever is higher). A maximum credit limit is also in place (\$5000).

21. Mortgages are only for house purchases. The house is used as collateral. If payments are missed then overdue interest is charged. If too many payments are missed (3 payments) the player can lose their house. Interest rates are typically low. Payments occur over a long time.
22. A player should have a place to live (rent an apartment, buy a house). Living on the street raises the chance of becoming ill considerably.
23. Not paying rent will result in the player being evicted (miss 3 month's rent).
24. A player must pay utility bills every month for their dwelling (Hydro, water, gas). Not paying bills (within 3 months) results in eviction from the dwelling.
25. A player needs to eat and drink, so they must purchase food and drinks on a regular basis. Not eating and drinking results in the player becoming ill, going to the hospital and missing work.
26. Tax is paid on everything.
27. If a player has purchased insurance and an item is stolen or broken, the item is replaced without question.
28. Players characters retire at age 65. Past this age the player loses control of the character. (To play again they need to create another character).
29. The player wins if they can afford to enter the old folks home (their retirement fund is large enough). They lose if they cannot afford to retire (they will be sent to the employment office).

Random Events

A series of random events have been added to the game to help keep the player engaged. These events include:

1. **Random Sickness.** There is a chance that a player's avatar can become ill. If they do become ill the avatar is sent to the hospital for a random number of days (1-7 days). While in the hospital the avatar cannot leave. Since they are in the hospital they cannot work either, so will experience a loss of income.
2. **Random Fines (and possible jail time).** An avatar can be fined. This fine must be paid with the avatars next pay. If they cannot pay they are sent to jail. The first incarceration is 1 day, increasing by 2 days up to a maximum of 9 days. Serving jail time pays the fine but results in a loss of income as the avatar cannot work.
3. **Insurance Claims.** Any item owned by the avatar in the virtual world can be lost to theft, breakage, etc. Insurance can be purchased to protect against this loss.
4. **Losing Cash.** Anytime a player uses their avatar's cash there is a small chance the money the avatar is carrying could be stolen or lost. This includes purchasing items, hiding cash, depositing it into a bank, etc. If it happens then all cash on the avatar will be lost, not just the amount involved in the transaction being processed.
5. **An avatar has a health value.** As days progress this value drops. The player must ensure the avatar eats enough to keep the value in balance. If they do not eat enough they will starve and wind up in the hospital. If they over eat they become obese and wind up in the hospital. In either case they cannot work and will lose pay for the days in the hospital.

Game timing

The game is designed to run in real time. When a player registers using the game web site, all necessary database entries for the player's avatar are created, with the exception of one, the record responsible for the avatar aging. The player's avatar will not start aging until they sign on to the game using the game client software. Once they sign on the first time, this aging record is created. The aging process starts immediately at this point. Once started, the aging process continues until the player's avatar retires. The game bases the passage of game time on weeks, with 1226 weeks considered the avatar's adult lifetime. When starting the game, the player's avatar is 18 years old. With the passing of 1226 weeks, this takes the player's avatar to 3 days less than 65 years of age, the retirement age. Once retirement age is reached, the aging record has a flag set indicating the avatar has retired. Once set, all financial transactions for this avatar cease.

The avatar's adult life in the real world is 30 days or 720 hours. As a result, a single two week period of game time will pass in approximately 35.23 minutes in the real world ($720 \text{ real hours} / 1226 \text{ in-world two week periods}$). A single day is $1/14^{\text{th}}$ of this time, approximately 2.51 minutes in the real world.

There are two timers that control timing in the game. A daily timer checks for the hospitalization, fines and the insurance claims random events. This timer processes all avatars that have an aging record that has not been marked as retired. These events may or may not occur to an avatar, and are determined by generating a random number.

The bi-weekly timer fires every 14 virtual world days, or every 35.23 minutes in the real world. It also fires for all avatars with a non-retired avatar age record. There are two separate bi-weekly cycles that can run, one for mid-month and one for the end of the month. The mid-month processing increments the avatars age record by 2 (2 weeks), pays them if they have a job, and increments the number of weeks studying if enrolled in school, possibly resulting in graduation. It also does processing to handle any time the avatar was in hospital and may send them to jail if they have a fine they cannot afford to pay. The end-of-month cycle is far more comprehensive. It does all the above plus does the financial transactions for the avatar such as making all necessary payments (rent, bills, etc), adding interest to savings and credit accounts and so on. Due to limitations of the timer object provided by the c# compiler, the exact value required to have the game last exactly 30 days could not be achieved. As a result, the game will actually run for 29.995 days, or 7 minutes short of 30 days.

There are a few other time-based events that occur in the virtual world. These events include the reduction of a player's health, time spent in hospital and/or jail, and time obtaining some sort of a degree at a school.

When a player begins the game, their health is set to a standard value of 500. As virtual world days pass, this value decreases by a value of 9-11 to represent the need for food and water. This value is modified when the daily timer fires, and the new value is reflected in the client software interface. If the player does not monitor their avatar's health, it will reach zero (starvation) in 46 to 56 virtual world days (between 1.9 and 2.2 hours real world time). Once the value reaches zero or lower, the avatar is sent to hospital for 9 virtual world days. Daily timer processing is responsible for sending the

avatar to the hospital once the health is at or below zero, and will release them automatically 9 days later, once they have been nursed back to health (and their health level returns to approximately 500). The daily process may also send the avatar to the hospital at random intervals for random sicknesses. When this occurs the avatar may spend from 1 to 7 days confined in the hospital. The daily process will release them automatically once this random time period has passed.

The avatar may also spend time in jail. When an avatar is fined, an entry is made in the database. This fine must be paid with the avatars next pay cheque, or with cash. The bi-weekly process checks for fines that need to be paid and attempts to pay them. If the fine cannot be paid, the avatar is sent to jail. Jail confinements start at a single day, and increase by two days for each incarceration, up to a maximum of 9 days. The daily process will determine if the avatar is in jail and will keep track of the number of days the avatar has been confined. When the required number of days has passed, it will be released automatically.

The final time-based components are when a player enrolls in one of the educational programs at one of the in-world schools. There are 4 degrees available, diploma which takes 2 years, bachelor which takes 4, Masters 6 years and PhD 8 years. A student may obtain one or more degrees. If they obtain a diploma, then enroll in a bachelor, they only need to study the extra 2 years over and above the diploma level. The same is true of any other educational level; the student must study for the length of time between the current degree and the one being sought. The only thing a player's avatar cannot do is try to obtain a degree lower than one they already have. If a player

has a master's degree, they cannot apply for a bachelor or diploma since their educational level already exceeds them.

When a player enrolls in the degree program, the degree is not awarded right away. A database entry is made indicating the degree being sought, and the length of time necessary to obtain it (for a new degree or the difference between a lower and higher one). During the bi-weekly cycle, the number of weeks studying is increased by 2. This value is then checked against the number of weeks required to obtain the degree. Once the weeks studying equal the required number of weeks, the degree is actually awarded. While studying, there is no real benefit to being in school. As a matter of fact, going to school is expensive, and will usually require some sort of a loan. Upon graduation (after the degree is actually awarded), the player's avatar is eligible to apply for jobs requiring that higher education level. The benefit to advanced education is jobs offer higher pay.

Game Play

The game is designed to be used as a learning tool in an elementary school program. The intent is for the teacher to use the game to supplement in-class education on personal finances, it is not meant as the sole method for teaching financial related concepts. The teacher may want to discuss finances first then have their students play, or they might have the students play then discuss the material. In any case the intent is not to focus on becoming wealthy - rather the intent is meant to stress the importance of making wise financial decisions.

The game is called 'Pecunia'. This word was chosen as it is a Latin term for 'Money', plus it sounds like a far away, mystical place. Students play as a resident of

Pecunia, living out their daily lives. The purpose of the game is for the players to amass wealth and belongings as they play. As the students play their characters grow and age. Upon reaching retirement age a check is made on the player's amassed wealth. If they have amassed enough wealth to retire they 'win'. If they do not they 'lose'. Regardless of whether they win or lose, once a player's character retires, that character can no longer be played. Should the student or the teacher want the student to play the game a second or subsequent time, the student will be able to reset their account. This will delete the students existing character, requiring the student to start the game from the beginning.

Before students can enroll, their teacher must register the class and provide the real names of the students that will be participating from that class. Once the teacher has entered the student's names, they will sign up using the interface to be provided. They will choose an in-game name (different from their real name) and a password for their account. A student can only play a single character at any one time. This character is loaded automatically when the player signs on. Each student will only have a single account as well. This is controlled by the teacher who identifies the students in the class.

Students start the game as young 'Pecunian' adults with the same possessions – the clothes on their backs and a sum of money. When they first sign on they will receive a message indicating the first task they should complete – finding a place to live. Decisions made by the students set the direction of their character. (Examples: If the student decides to buy a home right away they will not be able to go to school and will likely spend all the money they have; they will be limited on the type of home they can

buy as well. If they decide to work without getting an education this limits their job choices.)

Once they have arrived in the virtual world and read the informational message students are on their own. They can explore Pecunia as they wish. The student must be made aware that the game runs in real time. The initial sign in to the virtual world (using the client software) begins the aging process for their avatar. The avatar ages continually from this point on, regardless of whether the student is signed on to the server or not. This is meant to simulate real life – the student cannot simply take a break. They must make decisions for the long term that affect their avatar.

The game plays much like Second Life. In Second Life the player can do just about anything they like. There are no tasks to be performed, items to find, battles to fight, etc. The Pecunia game works much the same way, very free flow. There are not a lot of rules to follow, no one telling them what they must do, etc. the difference is the Pecunia game ends. The player must save enough to retire successfully (and win), otherwise they lose. Instead of living forever and not having anything to worry about, Pecunians must look forward to the future.

In the virtual world there are a variety of things the player can do. Everything is started by right clicking on a sign associated with a task and on a pie-shaped menu that appears, clicking one of the menu options. The menu option opens one of many dialogs that implement the things a player can do in a game. These actions range from opening bank accounts to renting apartments to buying food. The player is not really required to do anything. They could sign on once then never sign on again. This will definitely result

in the player losing the game. The more the player checks their character, the more likely the character will prosper.

Players are also able to interact with other players in the game. This social aspect is important to game play as financial decisions often have implications on many people, not only the player making the decisions. In addition, many players prefer a social environment where they can interact with other players. This interaction might be game related, or it may just be socializing. The social aspect is voluntary. While students may benefit from this aspect there is no requirement that they socialize, it is up to the individual player.

The game interface will show other players characters in the immediate area. A live chat function will be available to enable students to communicate with one another. Students will also be able to work together as they play the game. Examples of working together may include students advising each other where the best jobs are located, where housing is available, location of in world stores, etc. Players are also able to create items in the virtual world and offer them for sale. They will have the ability to create custom items on request for a particular player, or create items that are for sale to anyone playing the game. Players will also be able to assist each other when necessary through loaning of funds.



Figure 2. Avatar arriving in the game for the first time.

A typical game progression may occur this way. Once a player signs on for the first time they are placed in the welcome center. A message indicates they should locate an apartment.



Figure 3. Avatar at the apartment rental office.

Apartments are rented by locating the rental office in the virtual world. There are 14 apartments for rent, ranging from inexpensive, basic accommodations up to expensive garden apartments.

Once in the apartment they need to get basic necessities (food, water, and clothing). This will mean locating stores and shopping, spending yet more of their funds.



Figure 4. Avatar arranging restaurant deliveries.



Figure 5. Avatar at a restaurant buying a meal.



Figure 6. An avatar arranging grocery deliveries.

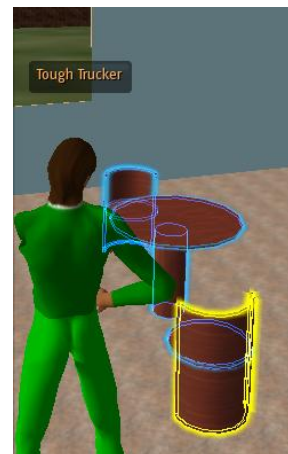


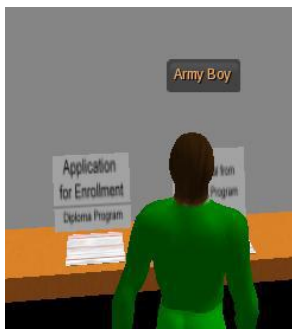
Figure 7. AN avatar buying furniture.



A bank account to hold their money is a good idea, so off to the bank to open a chequing account.

Figure 8. Avatar at the bank, opening an account.

The student, once set up in the apartment decides to take a course. Some courses they



might be able to afford outright, others will require a bank loan or some sort of credit. If they need credit then they need to find a bank and apply for it. Depending on the bank they may or may not be approved, so they may need to shop around.

Figure 9. Avatar enrolling in a diploma program at a school.



Upon graduation from their course they will get a job. Their earning potential is limited by their education (example: a doctor earns more than a plumber).

Figure 10. Applying for a job.

Once working they need to start to amass wealth. This is done by saving part of their pay. These savings can be short term for larger purchases, or long term for retirement. While working they are still living their lives, buying groceries, exploring the world, etc.

The players will also have the opportunity to purchase items to make their lives better. Things like better furniture, bikes, cars, better clothing will all be available. The better quality the student purchases the more money needs to be spent. It will be up to the student to balance their purchases with their income to ensure they can pay for purchased items. If they want they can apply for more credit by approaching a bank. It is up to the player to make their own decisions and live with the consequences.



Figure 11. Avatar looking at the retirement home.

Upon reaching retirement age the items and money saved by the player will be checked. If they have enough to retire the player 'wins' and the player's character will enter the Pecunian retirement home.

If they do not have enough to retire, the player's character will be sent to the employment office in the virtual world. In both cases this avatar can no longer be played.

The game progression described above is only one possible way the student may play. Actual game play will be dictated by the player.

System Architecture

When looking to build the game it was decided that currently available and free or low cost software solutions should be considered. The software chosen had to meet several requirements.

1. It must be a complete virtual environment.
2. It must operate over a network to allow multi-user connections.
3. The software must contain a method for players to communicate and co-operate while playing the game.

The software for the server tier will be 'Opensim'². This software is used to create virtual worlds similar to 'Second Life'. It was decided that the OpenSim server software was the better choice over using Second Life directly. Second Life does offer a lot of functionality that is required for the game; however there were several restrictions that made its use impractical. These reasons are as follows:

1. Second Life does allow a player's avatar to participate in financial transactions like purchasing items and getting a home, etc; however there is nothing that requires them to. These types of financial actions are the key to the game, so requiring the player to participate in them is important.
2. Second Life uses real currency. Since this is a game set in an elementary school it should not have any real money involved.
3. In order to implement the game, a private island in Second Life would be required. There is an up-front fee and monthly maintenance costs associated with this island (even for educational purposes).

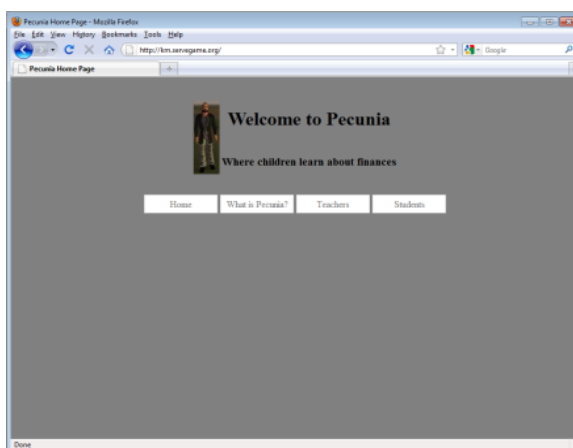
² http://opensimulator.org/wiki/Main_Page

4. While the island can be set to prevent non-game players from entering, there is nothing to prevent game players from going to other areas of Second Life (many of which are adult-oriented content).
5. Since Second Life is a commercial venture the source code and underlying database design is not available. This would prevent the changes necessary to the game from being implemented.

The Opensim software is released under the BSD software license, so source code is available. It can be used for a variety of purposes, from creating more open source software to commercial products. Opensim can be extended by using loadable modules. These modules can be created from scratch to perform a new, required function, or they can be downloaded from the OpenSim web site. Many of these modules also offer source code.

In addition to the 3D software used by the server, a variety of web pages have been designed. The web pages are described below.

- The main web page for the game contains functions that both the teacher and



student will use. There are four buttons on the web page. 'Home' returns the user to the main screen. 'What is Pecunia' displays a brief explanation of the purpose of the game.

Figure 12. Game main web page.

The 'Teachers' button has options that drop down when the mouse pointer is placed over top of the button. These options include a frequently asked questions

page (FAQ), an option to register to the site and a login option which can only be used after the teacher has registered and validated their account. The teacher must log in to access teacher only functions.



Figure 13. Teacher options.

The 'Students' button also has drop down options. These include an option to

register to the site which can only be done if the student's teacher has registered them to a class. The login option can only be used after the student has registered and validated their account. Logging in allows a student to perform student functions.

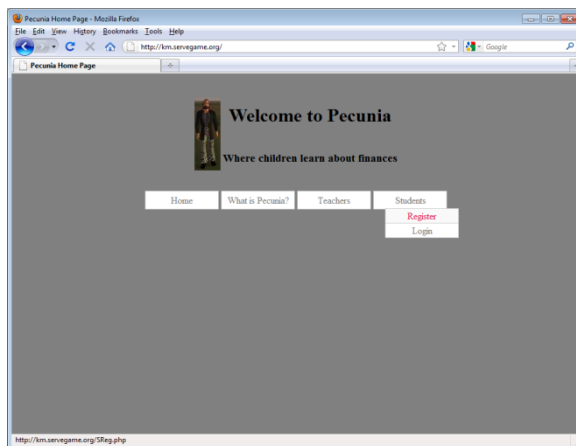


Figure 14. Student options.

- A page for a teacher to register has been created. Initially the teacher will enter their contact information (name, school, address, and phone number), an email address and a password.

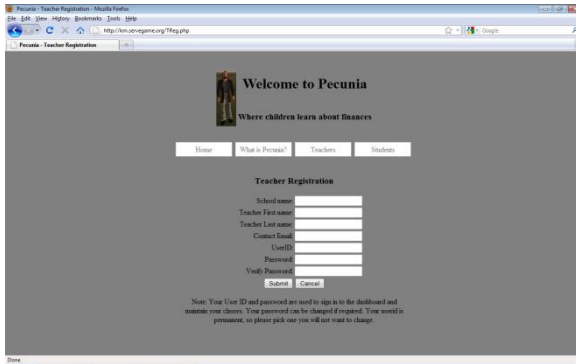


Figure 15. Teacher registration form.

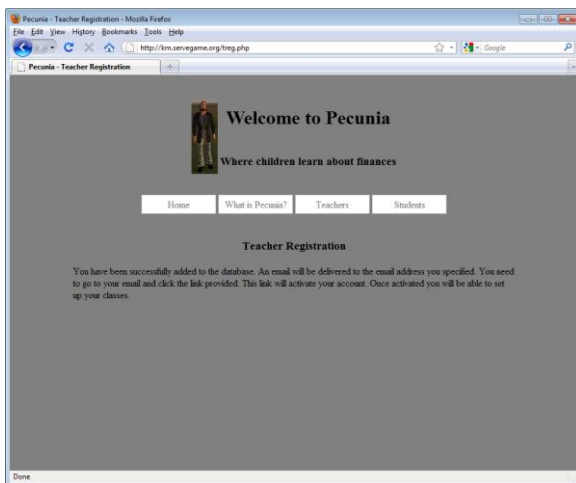
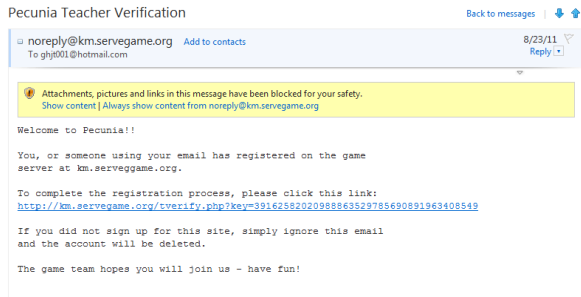


Figure 16. Successful teacher registration message.

Once completed, an email is sent to the email address provided. A screen shows the teacher that registration was successful and they must read the email sent and click on the link.



By clicking on this email the instructors account is enabled.

Figure 17. Verification email sent to the teacher.

- Once the instructors account is enabled the instructor can log on to the web site. The login screen contains links in case they have forgotten their userid or password. Clicking this link sends an email to the email address specified during registration.



Figure 18. Teacher login screen.

Once logged in the teacher is shown their dashboard. The dashboard allows the teacher to maintain personal information, maintain their classes and students in those classes.

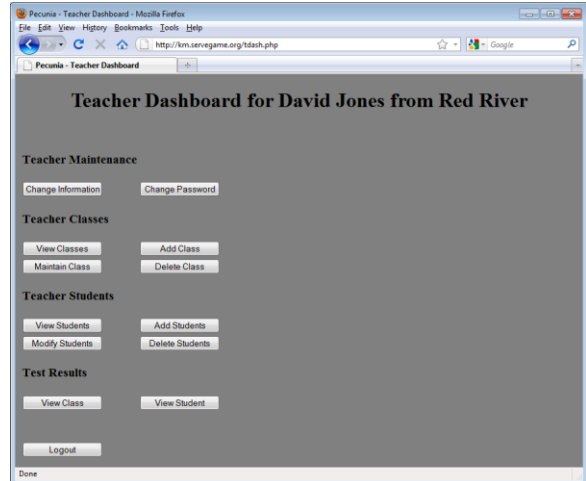


Figure 19. Teacher dashboard.

Teachers can change their personal information (Their name, school and preferred email address). They can also change their password for logging into the game web site

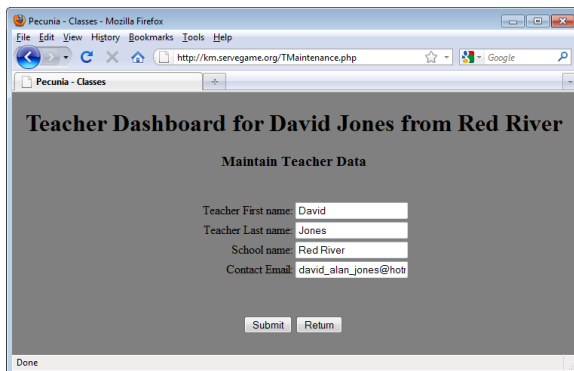


Figure 20. Teacher changing personal information.

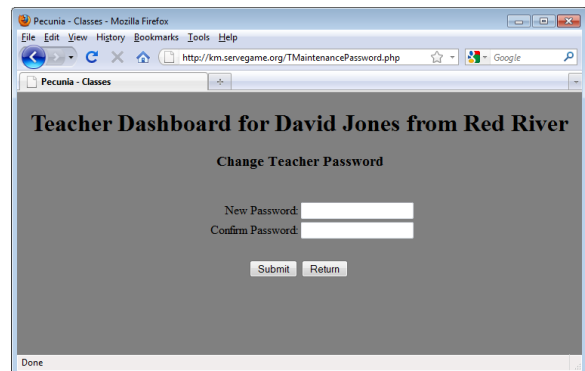


Figure 21. Teacher changing their password.

Teachers will be required to create one or more classes and enter students in those classes. Creating a class is accomplished by clicking 'Add Class'. The teacher needs to provide a description of the class (a string value used strictly so they can identify keep track of their classes). They must also enter the

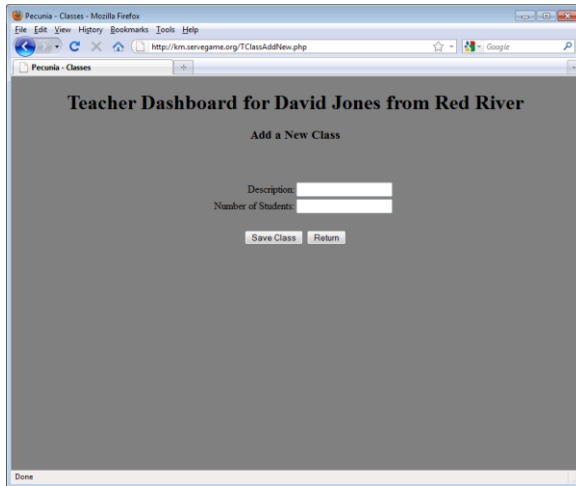


Figure 22. Add class dialog.

anticipated number of students in the class. This should be at least as many students as they believe will be added to the class. This number is used when the teacher adds students to the class. It can be changed to a higher or lower value as needed.

Classes can also be viewed, modified and deleted. When either of these functions is selected, a selection screen will be displayed asking the teacher to choose the class. The view option simply shows the class description and

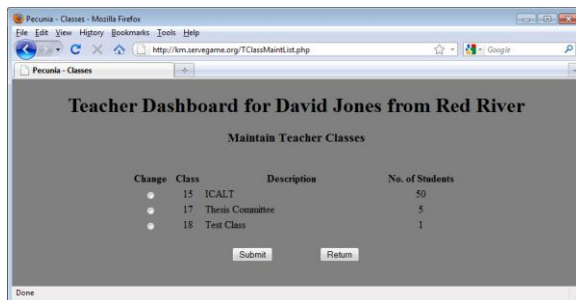
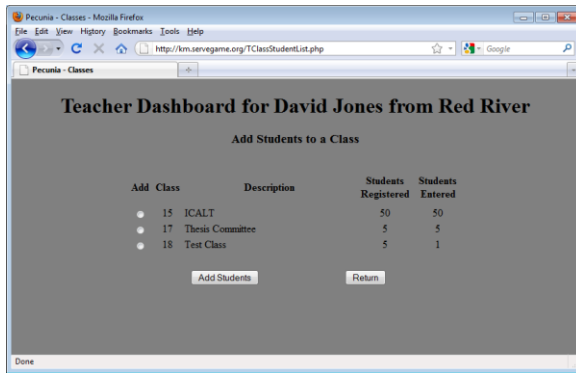


Figure 23. Teachers class listing (for modify, other dialogs are similar).

number of anticipated students. Modify allows this information to be changed. If delete is selected the class is immediately deleted without warning.

Teacher's accounts do not register as users on the game software. If teachers want to be able to play the game like their students they need to use a student account. (Teachers register to play the same as students do).

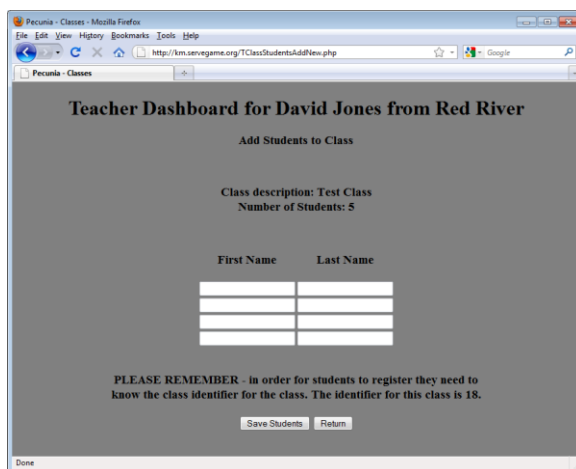
To add students, the teacher selects the 'Add Students' button. A list screen



displays all classes a teacher can add students to. To add students the teacher must select a class and click submit.

Figure 24. Add student to class list.

The add student screen appears. It will allow the teacher to add as many students as the anticipated number entered when the class was entered, less any students already added. In the diagram below the teacher anticipated there



would be 5 students and has already added 1. The screen will allow up to 4 more students to be added to the class. If the teacher needs to add more the anticipated number of students in the class must be increased.

Figure 25. Add student to class screen.

The students in a class can be viewed, modified and deleted. These dialogs work in a similar manner. The teacher is shown a class selection list and must choose the class to modify. They are then taken to the proper screen.

The view student screen shows the students in the class and the status of their accounts. The first student listed (Michael) has not attempted to log on to the game in any way yet. The second student has started the registration process (their avatar name is specified), but they have not read the email sent to their account and clicked the link (validated is No). The last student is fully registered to the web site and can log in.

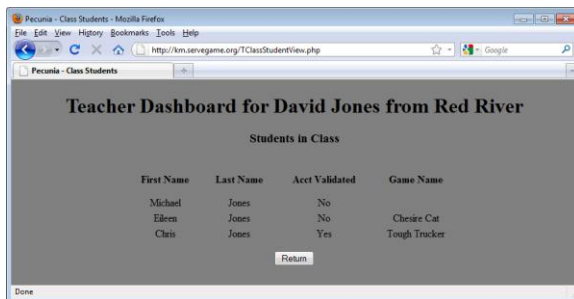


Figure 26. List of students in class.

The modify students screen allows the teacher to make changes to student names if necessary.

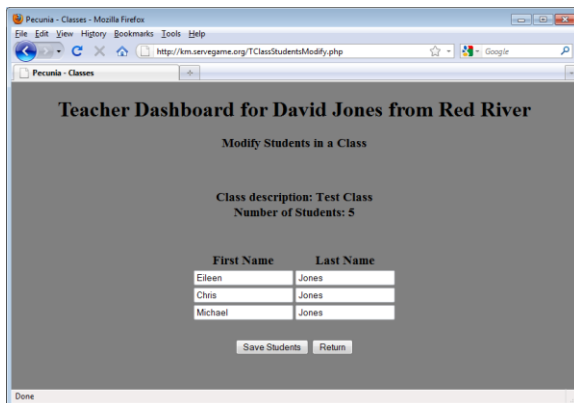


Figure 27. Modify student names.

The delete students' screen allows one or more students to be deleted from a

class at once. Deleting a student will delete both the student information from the game web site as well as all game avatar information from the game database, so it should be used with care.

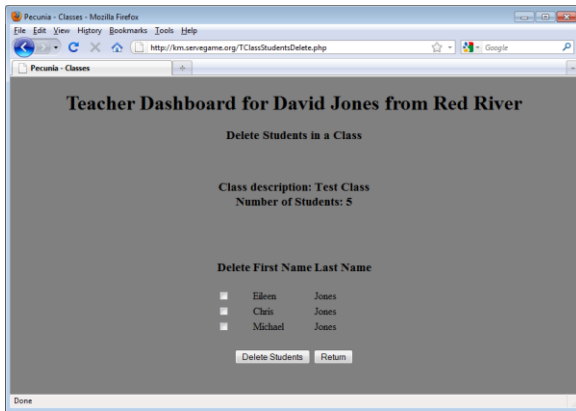


Figure 28. Delete student accounts.

- A dialog for students and the teacher to register to the server as a player. This dialog gathers a lot of information. Since the primary users of this dialog are grade 6 students the dialog only gathers a small amount of information at a time.

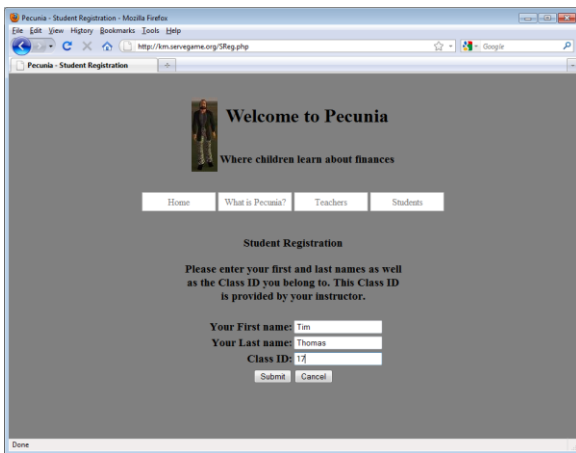


Figure 29. First page – real name and class identifier.

Players will provide their real name and class identifier to identify who they are to the server. The class identifier is provided to the student by their teacher. It identifies what class the student belongs to.

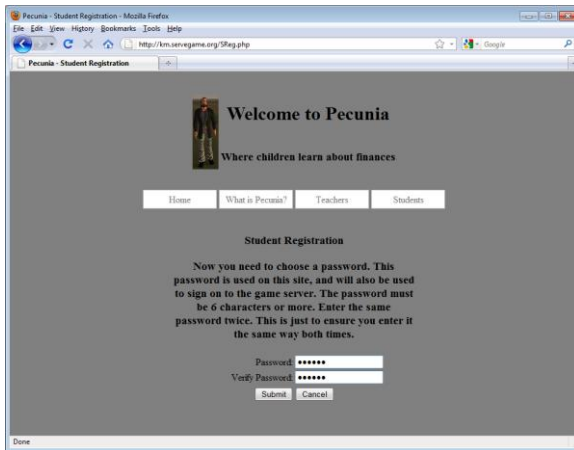


Figure 30. Second page - password.

A password must be provided by the student. This password is used to log into the game web page and is also used to play the game using the game software.

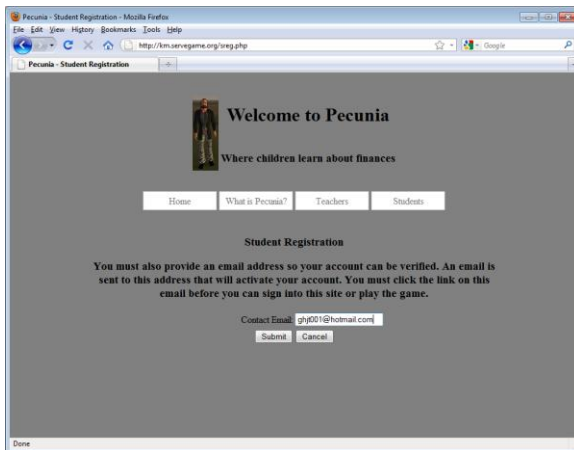


Figure 31. Third page - Email address.

The student must provide a valid email address. A verification email is sent to this address. The student must click the verification link to enable their account. If not verified, the student account cannot be used.

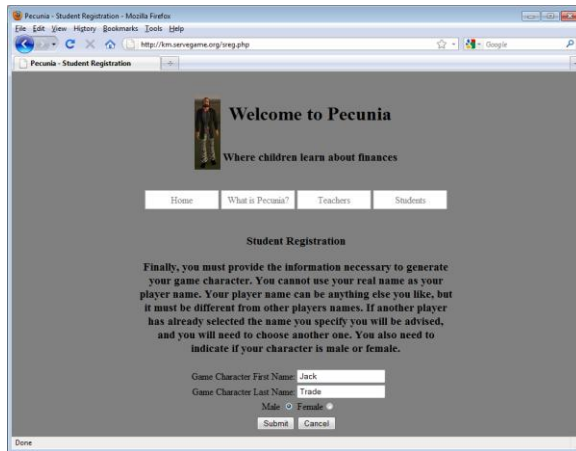


Figure 32. Fourth page – avatar name and gender.

The last part of the dialog requires the student to choose an avatar name and gender. Both are permanent – once chosen they cannot be changed. The avatar name cannot contain any components of their real name.

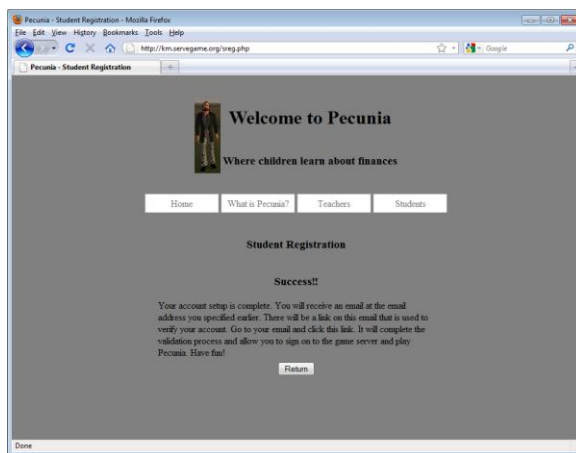


Figure 33. Final page - success message.

Once the dialog is completed an email is sent to the email address provided. A success message should display indicating the process is complete and the student must validate their account using the email.

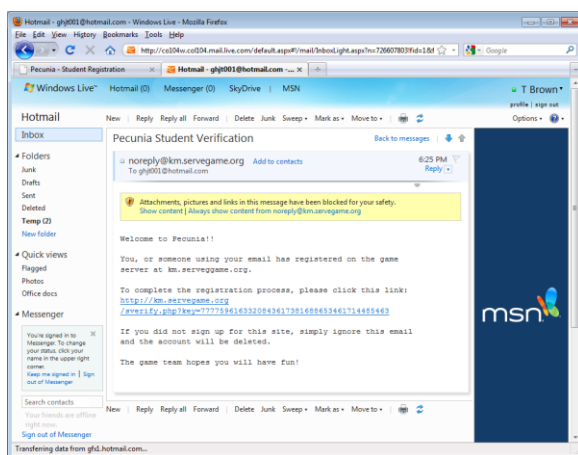


Figure 34. Verification email sent to student.

The email sent to the student contains a link back to the game web site. Clicking on this link will return the student to the site and will validate the students account allowing them to sign on.

- A main login page where players will enter their user names and passwords. This page will authenticate users to the server and sign them on to the game web page. The student signs on to the game web page and the game software the

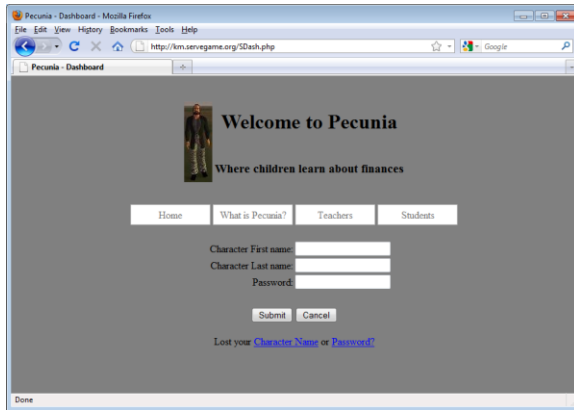


Figure 35. Student login screen.

same way, using their avatar name and the password the specified when they registered. If a student has forgotten their avatar name or password, they can be retrieved using the links on the bottom of the page.

- The student dashboard allows the student to perform necessary functions.

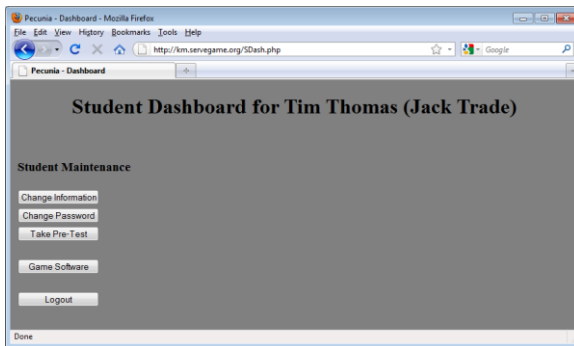


Figure 36. Students dashboard (new player).

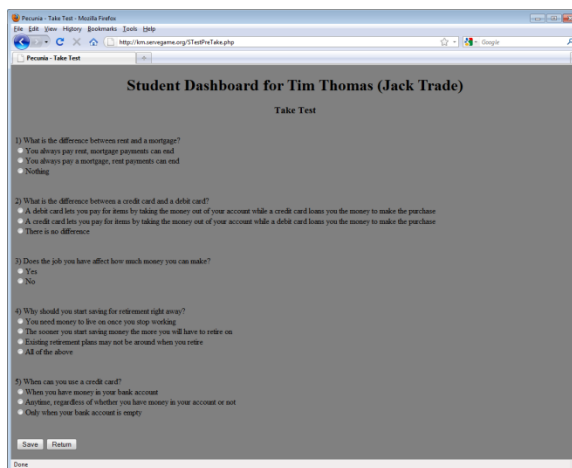
The player can change their personal information and password if necessary. This screen appears differently depending on the student's current status in the game. The

screen to the left represents what it looks like to a first-time player of the game.

When the player initially registers, a 'Take Pre-Test' button appears. This button will result in the pre-test questions being asked and creation of the player's avatar in the game world. Once taken, this button will disappear until after the student has completed playing the game and has completed the post-test. The

Post-test button only appears when the player's avatar reaches retirement age. The student can take the post test which asks the same questions as the pretest so learning can be measured. Once complete the player's avatar is deleted from the virtual world. The post-test button only appears after a player's avatar reaches retirement age and before the player completes the post-test. The player can also view test results. There are two buttons available. One button will show the most recent test taken. The second shows all tests taken. The second view test button only appears when the student has completed more than one test.

The 'Take Pre-Test' button displays five randomly selected questions on financial topics. The student must select an answer for each question then click 'Save'.



When 'Save' is clicked their responses are saved to the database and their avatar is created in the game world. The student cannot play the game until after they have completed this test.

Figure 37. Take pre-test screen.

The 'Take Post-Test' button screen is very similar, however processing is quite different. It asks the same five questions asked in the pre-test and it deletes the student's avatar from the game world when the student clicks 'Save'.

The 'Change Information' button allows the player to change their name or the email address they wish to use. The 'Change Password' button is used to change the password required to sign on to both the game web page and to the game world using the game software.

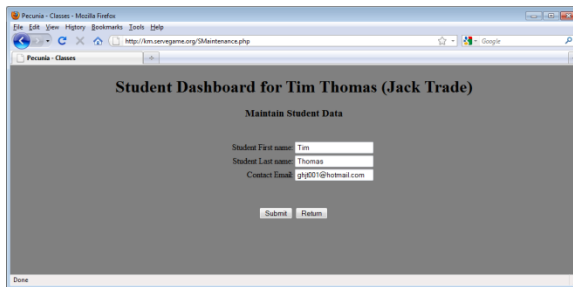


Figure 38. Changing student information.

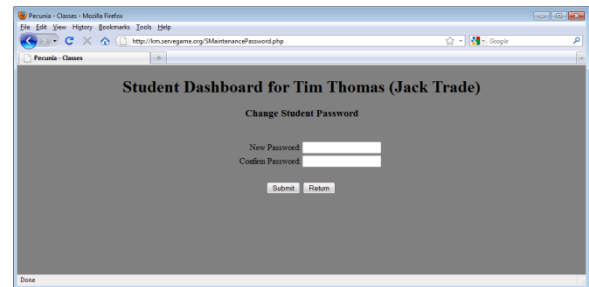


Figure 39. Changing student's password.

The 'Game Software' button allows the student to download game software if

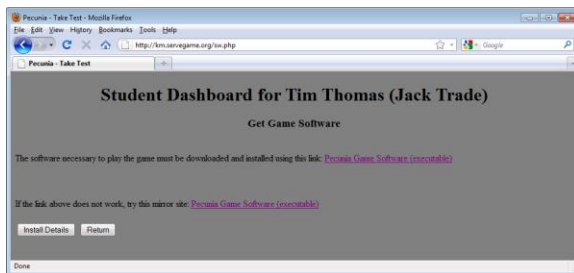


Figure 40. Getting the game software.

required. The software is available from two separate locations (in case one should be unavailable).

The screen also offers a link to a page with detailed install instructions if desired.

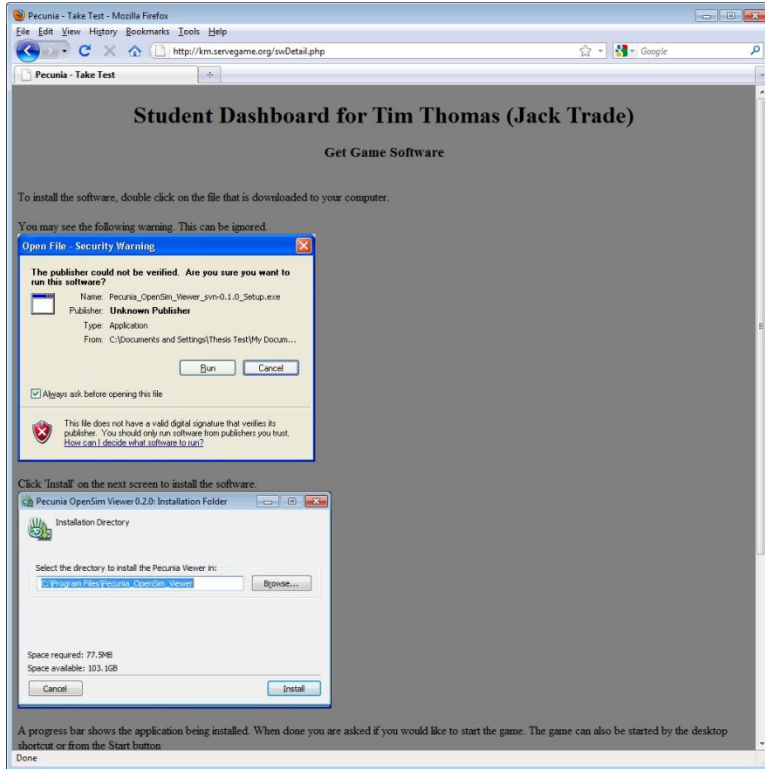


Figure 41. Detailed install instruction screen (partial view).

- A web page that displays the answers selected for the pre-test and post-test. The

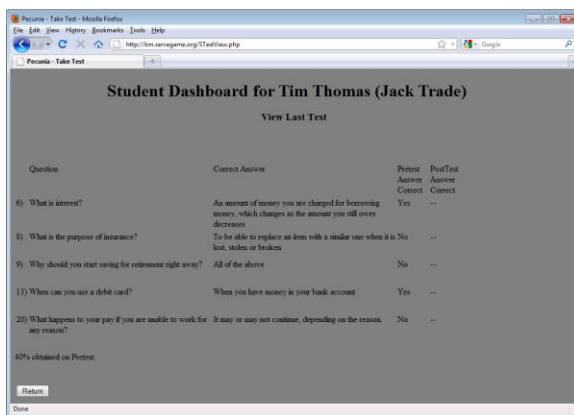
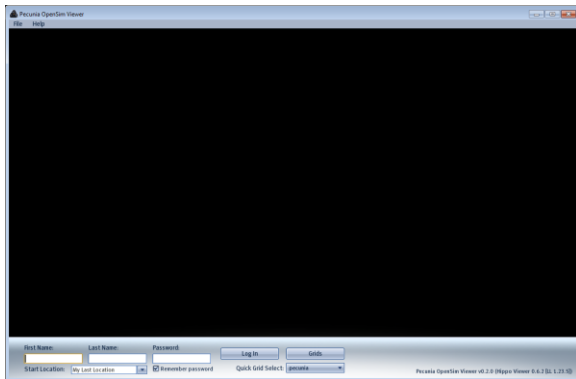


Figure 42. View last test results screen.

‘View’ and ‘View All’ buttons display a similar screen with ‘View’ showing the most recent test completed and the ‘View All’ button showing all tests with the most recent test listed first.

The client portion of the system uses the 'Hippo Opensim Viewer' which is one of the viewers available that can interface with the Opensim server software. The open source version of the Hippo viewer used was released under the GPL2 license.

This viewer contains a wealth of interface options. The intent of making the viewer open source is to enhance development of new viewers with yet more functionality. The game counters the desires of the open source community by actually reducing the functionality the viewer allows. The interface is far too complex and contains far too many options for younger students. The new viewer removes much of the unwanted interface, and simplifies the remaining interface. It provides an interface that is both easy to use and provides all required functionality.



This is the login screen provided by the game software. To play the game a student enters their avatar's name and password entered when the registered on the game web site and then clicks Login.

Figure 43. Login screen for game software.



To interact with items in the game the student needs to right click on the object. A pie shaped menu will appear. Depending on the item clicked on, the left center pie piece contains the action that can be performed. In this image, the student can rent an apartment.

Figure 44. Interacting with game interface items.

Financial information for the student's avatar is available using the status bar at the top of the screen (in red). 'Health' on the left indicates the players current health. This drops on a regular basis. It is up to the student to keep their avatar healthy. The dollar amount on the right indicates how much money the avatar has (cash). The buttons in between display other financial details that include food on hand and deliveries arranged, job status, education details, housing details and account details.



Figure 45. Controls and displays of financially related information.

Development Process

Development of the game used an Agile approach. This technique allowed for small parts of analysis, design, coding and testing to be done to ensure that individual parts of system functions properly. Once a group of functions were coded they were tested together in an integration test to ensure they all work together properly. The reason for this approach was due to the size of the development team. All analysis,

design, coding and testing was done by a single individual. Breaking a very large and complex game development project into smaller pieces simplified the game development process considerably.

Tools Used

Since cost is a major consideration in developing any computer system, the game was developed using software that could be obtained or used without cost as much as possible. In some instances this software was obtained as freeware or open source, in other situations the software was available to the development team.

The OpenSim server software was chosen as it is open source and free, it has a good 3D engine and a good support community. The Hippo client viewer software was chosen for the many of the same reasons; it is open source and free and has a good support community. It is also one of the only viewers that is fully supported by the OpenSim software.

The 3D server software was designed to run on Microsoft Windows Server 2003 software only. While the OpenSim server software does run on multiple operating systems (O/S), only the Server 2003 O/S was developed. This was done for two primary reasons: First, the development team had a lot of familiarity and access to Microsoft Windows Server 2003. Second, an attempt had to be made to reduce to scope of developing the server side 3D engine. Attempting to develop across multiple O/S's using multiple development tools would be very difficult.

The server also needed a variety of web pages for registration, connection, etc. The server uses the Apache HTTP Web Server, PHP for server side scripting and a

MySQL database engine. The advantage to using these products is they are all open source and free.

The Hippo Viewer client will be designed to run on Microsoft Windows only. Two versions of Windows will be tested – XP and Windows 7. While the software might work on other Windows versions it will not be guaranteed (since the development team did not have access to other versions). Like the server software, Windows was being used since the development team had access to it and it was an attempt to reduce project scope.

For development and testing purposes the developed 3D server software was located on a stand-alone server. The client (Hippo) was developed on a Windows XP machine and was packaged as a distributable that can be installed on either a Windows XP or Windows 7 computer. Testing was done from a client connected to the 3D server over a network connection.

CHAPTER IV

Evaluation Plan

How to measure learning

Since the interest in using games for educational purposes is just beginning, evaluation methods are varied and can be somewhat inconsistent. One approach is to use a case study [25]. Another common approach is to test knowledge on the game subject matter before game exposure (pretest), then test on the same subject matter after playing (posttest) [13][64]. Once both evaluations are done the results are compared. The advantages to using the pretest and posttest approach is it is already used in a variety of situations, from testing learning in courses as well as learning experienced by playing games.

Since pretest and posttest evaluations are already used to evaluate the effectiveness of education in courses and games, this is the method that will be employed.

Before playing, students must complete the pre-test which asks questions from a test bank of 20 financial questions. Completing the pretest is required as it actually generates the student's avatar in the game world.

In addition to the pre-test, the student is also given the first part of a two part questionnaire (Appendix E). The information collected in the first part of the questionnaire includes demographics on the player as well as their experience with computer games in general. The questionnaire also collects information on basic computer experience and computer game attitudes using a modified Computer Game Attitude Scale (CGAS). This scale is used to measure the player's attitudes towards

computer games. The scale was first introduced in 1997 and has proven to have strong validity and reliability in measuring attitudes [4].

Once complete, the student can sign on to the game world using the game software and begin to play the game. When their avatar reaches retirement age it will be moved to the retirement home if it has enough to retire or employment office if it does not. Once moved, the avatar cannot be played any longer (it is limited to that location and cannot leave).

Upon completion of the game the student needs to sign on to the web page and complete the post-test of financial questions. They are also asked to complete the second part of the questionnaire. This questionnaire (Appendix F) will obtain the following information:

- Perceptions and Attitudes towards the game using a modified Technology Acceptance Model (TAM) questionnaire. This model, introduced in 1986, has been widely adopted because it is easy to implement and is fairly simple to use. The original intent was to measure user's acceptance of technology. Since its initial release it has been revised to measure external variables including attitudes and perceived ease of use and usefulness [28].
- Usability information by using a modified altered System Usability questionnaire. Usability measures whether the system is easy to use, efficient to use, is easy to remember, has few errors and is pleasing (in a subjective manner) [33].

Since the preferred target audience of the test is grade six students, several components of the questionnaire have been simplified. Some questions were removed

altogether, while others had wording changed. The intent was to reduce the question complexity down to an appropriate level for a grade six student.

Experiment

For the experiment, some of the web functionality was removed, and other minor changes were made. The teacher's component was eliminated completely as it was deemed unnecessary. The student's component was also modified so students could register themselves, instead of needing to be enrolled in a class by a teacher. The web interface was modified so all students enrolling were actually placed in a test class that could be checked. This was necessary as the web interface provided the results of the pre-test and post-tests, required for analysis.

Since the participants of the test are grade 6 students, their parents will be required to complete a permission form (Appendix D). Once completed, the student can register to the game web site.

The experiment is based on basic household financial situations. A series of true/false and multiple choice questions have been drafted using examples obtained from various financial institutions, financial education institutions and organizations and questions developed by the researcher. The questions and correct answers will both be stored in the server database. The pre-test will be given to the student when connecting to the game web site before playing the game. At the same time they will be asked to complete part 1 of the questionnaire. The post-test will become available to the student once their avatar has retired. This test is also available from the game web site. Taking the post-test will allow for the measurement the amount of learning for a student. After

completing the post-test, the student can complete the final part of the questionnaire (Part 2).

A single class will be used as a test class. The individuals will enroll themselves using the revised web interface. They will then complete the pregame test and first questionnaire. After downloading and installing the game software, they can sign on and begin exploring the world. They will continue to play the game over a period of 10 days, approximately 30 minutes per day. At the end of the 10 days the players characters will be 'retired' and they will need to complete the post-test and questionnaire.

The experiment consists of the students playing a single game from first sign on until retirement. For the duration of the test, the students can only play a single time. Once retired, the web interface functionality is no longer available.

CHAPTER V

Evaluation and Discussion

This chapter will focus on an experiment done to evaluate the effectiveness of the game that was designed and developed. The chapter begins by explaining the experiment used to test the game. This section includes a description of the participants, the procedure used and the questionnaires and tests that gathered information for analysis.

The next section discusses the evaluation of the information gathered from the questionnaires. Due to the limited size of the test group and its make-up, some of the information gathered was unusable for this research project. As a result, several of the intended hypotheses could not be tested. As a result, the hypotheses that can be tested are discussed after the data is checked for reliability and validity.

Finally, the analysis of the data is done to check if the hypotheses suggested can be proven or not.

Experiment Design

Participants

Nineteen participants initially registered to participate in the experiment. At the end of the testing period, three of the volunteers, two females and one male, withdrew for personal reasons. Although they did register and completed the pre-test and the first part of the questionnaire, these results have been removed from consideration. The actual number of participants that this research works with is 16.

Participants ranged from 11 to 51 years of age, 11 of which were males, and 5 females. Seven of the participants were adults (19 or older), while the remainder of the

participants ranged in age from 11 to 18. The experiment took place in the participant's homes on their own personal computers, using software downloaded by the participant to play the game.

Registration Process

To register the participants, I visited their home in the early evening or on a weekend. Before visiting, I spoke to the volunteer's parents (if they were a child or youth) to ensure they approved of their child participating in the study. I also informed the parent that they needed to be present during set-up. This was done for several reasons. The parents needed to sign a consent form before their child could play, so this form was obtained during this visit. It also allowed the parent to follow along with the registration process and ask any questions and possibly provide some level of support if their child encountered problems playing the game.

A typical visit started with a fairly detailed explanation what was requested of the participants, including completion of the pre-test and post-test, two parts of the questionnaire, and playing the game for 10 days. Before starting anything, I provided the parent and child with a written explanation of the process. I then asked the parent to sign the consent form. Once signed, I asked the participant to complete the first part of the questionnaire and began the actual registration of the player.

During the registration process I tried to have the player complete the process themselves. They first had to navigate to the game web site, register and validate their account. After the registration process was completed the student signed in to the web site. I briefly explained the options available to them then asked them to complete the pre-test. Once this test was completed their avatar was created in the game world. They

were advised that after their avatar retired they would need to return to the web site to complete the post-test.

I then had the player download and install the game software. Once installed the player started the game software and signed on using their account. This served two purposes. By having the student sign in immediately their avatar began aging and experiencing life events. This started the game for the player, requiring them to start monitoring the avatar. It also allowed me an opportunity to demo the software. I showed them the most used functionality so they knew how to do the basic tasks in the game. I also did a demonstration of some of the most often used interface items.

In a few instances the player was unable or unwilling to start playing the game on the night they registered. In this case I signed on to the game using an account that had been used during testing. While signed on as my character I did the demonstration, showing the software concepts mentioned above.

Once the players completed playing the game (their avatar was retired), they completed the post-test by returning to the web site, and completed the second part of the questionnaire which was left with the player's parent when they were registered. These questionnaires were either returned to me by the parents or I made arrangements to return to the player's home and pick them up.

The Questionnaires

Due to the size of the original questionnaire and the age of most of the participants, it was decided to split it into two components. Part 1 was completed by participants just before they registered to play the game. This part gathered

demographic information, experience playing computer and video games as well as attitudes on computers and computer games in general.

For the experiment, the CGAS 2011 questionnaire [32] developed by Lu was used. Modifications needed to be made to this questionnaire so it could be used in the research. In particular, two questions were dropped as they were not relevant to the research and the age of the participants being tested. In addition, the questions were reworded to be simpler so they could be understood by the intended audience (grade 6).

This questionnaire has 29, five point Likert-scale items (5 for “Strongly Agree” to 1 for “Strongly disagree”). These 29 items are categorized into 5 factors listed below:

- Attitude toward computer;
- Attitude toward computer games;
- Comfortable;
- Liking;
- Confidence.

Part 2 of the questionnaire was also based on the questionnaire used by Lu in 2011 [32]. The original questionnaire contained many questions specific to that specific research project. As a result, 14 of the items were removed. This questionnaire also uses the five point Likert-scale items (5 for “strongly agree” to 1 for “strongly disagree”). The questionnaire addresses the four main constructs of the Technology Acceptance Model (perceived ease of use, perceived usefulness, attitudes toward using and behavioral intention of using) as well as the three constructs of usability (the systems

effectiveness, the systems efficiency and the users satisfaction). The questionnaires can be found in Appendix E and Appendix F.

The Pre-Test and Post-Test

Before students can start the game, they must sign on to the game web site and complete the pre-test. Completion of the pre-test is mandatory as the student's in-game avatar is not created until after the pre-test has been completed. Once the student's avatar has been created the pre-test will no longer be available on the web site. The student must play the game until their avatar retires, then they can complete the post-test.

When the student takes the pre-test they will be asked the questions in Appendix A. The order of questions asked of each student will be determined at random. The answers to the pretest questions will be recorded into the server database before the student begins the game.

The post-test will become available to the student once their avatar has retired. This test is also available from the game web site. When the student has completed the post-test it can be determined how much was learned by comparing the answers to the pre-test and post-test.

Results

Statistical information will be available to students on the game web site. They are able to sign on and see the results of the pre-test once it has been completed. Once their avatar has retired and they have completed the post-test the results of both tests are available. In both cases, all questions are shown along with the correct response. The list also indicates whether the student answered the question correctly or not.

Finally, a percentage score obtained on the test is listed at the bottom. This will allow students to do further research if they are interested.

Information gathered on the questionnaire will be used to evaluate the effectiveness of the game. This information will be reported below and will not be made available directly to test participants.

Data Collection

The experiment began on January 12th and ran for approximately 29 days. During this time participants were registered and started playing the game. A problem getting the participants registered was encountered as the testing period coincided with exam weeks in many of the schools. Some students were not available early in the test, while others were not available later on. In addition, several of the participants had many extra-curricular activities they were involved with. As a result, the maximum number of students registered and actively playing the game at the same time was about 10. This did have an effect on the 'multiplayer' component of the game since players rarely saw others playing at the same time they did.

Once the participant's avatar was retired they were to complete the post-test and the second part of the questionnaire. When getting the questionnaires back I took the opportunity to discuss the game and gather participant's views. The questionnaire did not provide an opportunity for the participants to express likes, dislikes, etc in the game, so a brief discussion allowed me to gather some of this information. Some of these facts will be discussed later on.

Validity and Reliability Analysis

The questionnaire was adopted from previous research so its validity and reliability have already been proven by other researchers. In validating the CGAS 2011 questionnaire [32], Lu discovered that the 'Behaviour' factor could not be reliably used. As a result, this factor is not considered in this research (even though the 'behaviour' questions remain on the questionnaire). All the remaining factors will be investigated.

CGAS Questionnaire Reliability and Validity

The first part of the questionnaire contained the CGAS items. The questionnaire was modified slightly for this research project. In particular, two items were removed; question 13 dealing with computer expos and question 16 which deal with playing computer games after an exam. Question 13 belongs to the liking factor and question 16 belongs to the comfortable factor. Since these two factors are only reduced by a single question it should have minimal effect on the reliability of the questionnaire. The table below shows the factors and items included each factor.

The first step was to perform a reliability analysis of the factors to be used. Performing this analysis on all 29 questions resulted in a Cronbach's Alpha value of .8533 [63]. This alpha factor value resides in the 'good' range, meaning the questionnaire in its entirety is reliable. Next I measured each individual component in the questionnaire.

Factor	Description	Items	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Attitude Towards Computers	The users attitude to computers in general	AC-Q1 AC-Q5 AC-Q9 AC-Q11 AC-Q28	0.2679 0.463 0.3868 -0.0185 0.4003	0.372

Attitude Towards Computer Games	The users attitude to playing computer games	ACG-Q22 ACG-Q26 ACG-Q28 ACG-Q29	0.1618 0.7087 0.4521 0.4514	<u>0.5626</u>
Comfortable	The users level of comfort in using computer games	COM-Q2 COM-Q3 COM-Q4 COM-Q15	0.6952 0.6716 0.7528 0.7119	0.765
Liking	Expresses how the player likes to be challenged by the computer game	LIK-Q7 LIK-Q8 LIK-Q25	0.6614 -0.1892 0.2441	<i>0.3535</i>
Confidence	The users confidence when playing games	CFD-Q18 CFD-Q19 CFD-Q20 CFD-Q21	0.9457 0.9365 0.9559 0.9396	0.9578

Italics: Cronbach's Alpha value is less than .7

Italics and Underline: Cronbach's Alpha is below .7 but can be increased by removing a question

Bold: Cronbach's Alpha is over .7

Table 2. Reliability Analysis of CGAS 2011 questionnaire.

In the table above, two of the factors, 'Attitude towards computers' and 'liking' contain low alpha values. Any factor that has an alpha score below .7 is considered to have questionable reliability, so these factors will be removed from further analysis.

The reasons for these factors scoring so low may be a result of the participants in the test. Participants consisted of both adults and youth. While the majority of children and youth in the experiment had positive attitudes to and liked using computers, several of the adults did not. The adults seemed to be more cautious when using the computers to play the games. Another factor that may have affected the results is the number of participants in the test. With only 16 taking part, the results may not be totally accurate.

Another factor, Attitude to Computer Games, also scored poorly in the reliability test. This factor differs from the others in that it can be raised to an acceptable alpha level by removing a question (Q26). Further investigation shows that this question was a poor fit in the factor, so this may result in the low initial value. The factors mentioned above (participant composition and sample size) may also have had an effect on the initial alpha value generated. The table below lists the factors to be used, items in each factor along with the Cronbach's Alpha for each one.

Factor	Items	Cronbach's Alpha
Attitude towards computer games	Q22, Q28, Q29	0.7087
Comfortable	Q2, Q3, Q4, Q15	0.7650
Confidence	Q18, Q19, Q20, Q21	0.9578

Table 3. Factors to be investigated by the CGAS questionnaire.

With the reliability of the factors determined, I checked the items validity in the factors.

	Components		
	1 (ACG)	2 (COM)	3 (CFD)
Attitude Towards Computer Games-Q22	.796	-.256	.462
Attitude Towards Computer Games-Q28	.733	.088	.194
Attitude Towards Computer Games-29	.737	-.057	-.134
Comfort-2	.008	.543	.600
Comfort-3	-.235	.671	.549
Comfort-4	-.256	.721	.082
Comfort-15	.275	.904	.045
Confidence-18	.272	.214	.880
Confidence-19	.037	.056	.973
Confidence-20	-.049	.096	.930
Confidence-21	.314	.166	.889

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Bold and underline: item's factor loading for the pre-defined component is less than 0.6

Bold and italic: item's factor loading is over 0.6 for the component other than the pre-defined one

Table 4. Validity Analysis of CGAS Questionnaire.

As can be seen from the table above, all items with the exception of one in 'Comfort' (item Comfort-2) have a high enough value for inclusion in further analysis. This item supposedly fits into the 'Confidence' factor, however when reviewing the question, it seemed a poor fit. As a result, this question was removed. The final valid and reliable CGAS questionnaire to be used is listed in the table below.

	Components		
	1 (ACG)	2 (COM)	3 (CFD)
Attitude Towards Computer Games-Q22	.791	-.258	.467
Attitude Towards Computer Games-Q28	.733	.132	.211
Attitude Towards Computer Games-29	.736	-.093	-.133
Comfort-3	-.239	.660	.557
Comfort-4	-.253	.762	.098
Comfort-15	.279	.893	.053
Confidence-18	.264	.194	.884
Confidence-19	.029	.047	.971
Confidence-20	-.057	.104	.934
Confidence-21	.305	.159	.898

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Table 5. Final Valid and Reliable CGAS Questionnaire.

TAM Questionnaire Reliability and Validity

The second part of the questionnaire which was completed after the participants played the game is a modified Technology Acceptance Model (TAM). This questionnaire was modified significantly from the one used by Lu in 2011. His questionnaire had added a number of factors specific to that research project [32]. The factor Context awareness, which was comprised of 6 questions, and Voluntariness of Use which contained 5 questions were removed for this research project. In addition, three other questions that were not appropriate for the target age group were also removed. The first question in the Perceived Usefulness factor asked about generated learning activities, which did not exist in this game. The second question in the Attitude towards the game factor asked about future versions. The third factor which was in the Perceived Ease of Use factor asked a question on systems flow.

When Cronbach's Alpha [63] is determined, the entire TAM questionnaire received an alpha of 0.818, which resides in the good range. This indicates the TAM as a whole is reliable. Next, a check of each of the factors used in the questionnaire was completed.

Factor	Description	Items	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Perceived ease of use	Users perception of how easy it was to play the game	PEoU-Q01 PEoU-Q02 PEoU-Q04 PEoU-Q18 PEoU-Q19 PEoU-Q21	0.6093 0.5304 0.8244 0.6358 0.3394 0.5026	<u>0.6509</u>
Perceived Usefulness	Users perception of how useful the game was	PU-Q3 PU-Q20 PU-Q22 PU-Q23	0.7834 0.8307 0.6080 0.6414	0.7860

Freedom in Game	Users feeling about the freedom allowed in the game	FG-Q7 FG-Q8 FG-Q9 FG-Q10	0.8000 0.8048 0.8348 0.7778	0.8464
Attitude to game	Users attitude to the game	ATT-Q5 ATT-Q6 ATT-Q15	0.1628 0.3073 0.5876	<i>0.4979</i>
Intention to using the game	Users behavioral intention of using the game	IT-Q11 IT-Q12 IT-Q13 IT-Q14 IT-Q16	0.6744 0.6557 0.7241 0.7087 0.8124	0.7589

Italics: Cronbach's Alpha value is less than .7

Italics and Underline: Cronbach's Alpha is below .7 but can be increased by removing a question

Bold: Cronbach's Alpha is over .7

Table 6. Reliability for Questionnaire Part 2 (TAM) components.

As can be seen by the reliability analysis of the TAM components, the 'Attitude to Game' factor has a very low alpha value. Since this factor cannot be increased to an acceptable level, it must be removed from further analysis. The reason for this low factor may be due to the composition of the participants. Adults might not have found the game as useful as many already knew many of the concepts to be taught in the game.

The 'Perceived Ease of Use' factor also has a low alpha score; however this factor can be improved by removing question #4. This question was targeted at locating functions in the game. During discussions with participants after playing the game it became evident that younger and inexperienced players had difficulty in this area, while older or more experienced players were not as affected. The wide range of answers in this question might have skewed the results. As a result, the question will be removed from the factor.

Next the validity of each of the remaining factors was determined using Principal Components Analysis. The results of this analysis are listed below.

	1 (PEoU)	2 (PU)	3 (FG)	4 (INT)
PEoU-Q1	.702	-.320	.220	.174
PEoU-Q2	.726	.265	.393	-.392
PEoU-Q18	.432	.232	.493	-.603
PEoU-Q19	.920	-.001	.017	-.052
PEoU-Q21	.788	.027	-.212	-.039
PU-Q3	.170	.552	.306	.708
PU-Q20	.487	.334	-.122	-.243
PU-Q22	.574	.436	.447	.230
PU-Q23	.524	.637	.305	-.009
FG-Q7	.198	.164	.876	.164
FG-Q8	-.399	-.141	.827	-.077
FG-Q9	.314	-.029	.774	-.239
FG-Q10	-.180	.366	.786	.240
INT-Q11	-.087	.216	.073	.799
INT-Q12	.101	.772	.355	.451
INT-Q13	-.228	-.006	.067	.792
INT-Q14	.191	.089	-.142	.889
INT-Q16	-.108	.779	-.060	.085

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 Rotation converged in 9 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Bold and underline: item's factor loading for the pre-defined component is less than 0.6

Bold and italic: item's factor loading is over 0.6 for the component other than the pre-defined one

Table 7. Item assignments in TAM questionnaire.

As can be seen by the validity table above, three of the factors have issues that need to be addressed. On the Perceived Ease of Usefulness, question 18 does not contribute to any factor with a value above .6. In Perceived Usefulness (PU), 3 of the four questions do not contribute to the factor (or any other factor, either). In the Intention (INT) factor, two of the questions do not contribute it. One contributes a small amount (.451), while the other only contributes .085.

In an attempt to have the items contribute to the pre-defined factor better, questions 18, 16 and 20 were removed. Questions 18 and 20 are removed as they do not contribute to any factor with a high enough factor loading value. Question 16 was removed as it offered minimal loading to the component. Once these questions were removed, the principal components analysis was done again, resulting in the table below.

	1 (PEoU)	2 (PU)	3 (FG)	4 (INT)
PEoU-Q1	.850	-.043	.154	.105
PEoU-Q2	.627	.512	.243	-.433
PEoU-Q19	.898	.220	-.110	-.072
PEoU-Q21	.669	.264	-.355	-.112
PU-Q3	.041	.685	.141	.669
PU-Q22	.396	.723	.259	.177
PU-Q23	.279	.879	.088	-.101
FG-Q7	.166	.446	.773	.152
FG-Q8	-.288	-.019	.870	-.079
FG-Q9	.432	.123	.754	-.202
FG-Q10	-.198	.473	.726	.234
INT-Q11	-.088	.152	.068	.852
INT-Q12	-.048	.790	.198	.453
INT-Q13	-.180	-.054	.087	.841
INT-Q14	.182	.173	-.211	.837

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 Rotation converged in 7 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Bold and italic: item's factor loading is over 0.6 for the component other than the pre-defined one

Table 8. Revised Item Assignments in TAM Questionnaire.

While removing the questions above did help correct item assignments into the proper component, one item in Intention (INT), question 12, still does not fit into the predefined category. A comparison of the questions in Perceived Usefulness and Question 12 was done to see if the question needed to be moved to a different factor. After reviewing the questions it was decided that the question did not fit properly in the

category. Another attempt was made to correct the placement of questions by removing question 12 from further analysis. The principal component analysis revealed the following results.

	1 (PEoU)	2 (PU)	3 (FG)	4 (INT)
PEoU-Q1	.815	.055	.128	.079
PEoU-Q2	.566	.617	.231	-.394
PEoU-Q19	.907	.246	-.095	-.056
PEoU-Q21	.692	.263	-.323	-.070
PU-Q3	.031	.573	.173	.732
PU-Q22	.312	.787	.252	.248
PU-Q23	.209	.913	.094	-.016
FG-Q7	.106	.481	.762	.182
FG-Q8	-.273	-.056	.877	-.085
FG-Q9	.458	.106	.771	-.203
FG-Q10	-.190	.376	.758	.279
INT-Q11	-.094	.071	.074	.858
INT-Q13	-.162	-.150	.098	.833
INT-Q14	.185	.102	-.194	.857

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Bold and italic: item's factor loading is over 0.6 for the component other than the pre-defined one

Table 9. Revision #2 of items in TAM questionnaire.

Once again the items in the factors do not seem to contribute to the proper factor. In this scenario there are two questions to be investigated. In the Perceived Ease of Use factor, question 2 seems to fit better in Perceived Usefulness and question 3 of Perceived Usefulness seems to fit better in Intention. After careful review of each of the items it was decided that these changes seemed to make sense, so the factors were realigned. This required a recalculation of Cronbach's alpha to ensure all factors are still reliable. In this recalculation, the overall alpha value obtained is .8040 which is in the good range, meaning the questionnaire is still reliable in its entirety. Individual components scores are listed below.

Factor	Description	Items	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Perceived ease of use	Users perception of how easy it was to play the game	PEoU-Q01 PEoU-Q19 PEoU-Q21	0.8326 0.446 0.5863	0.7688
Perceived Usefulness	Users perception of how useful the game was	PU-Q2 PU-Q22 PU-Q23	0.8424 0.8057 0.7545	0.8616
Freedom in Game	Users feeling about the freedom allowed in the game	FG-Q7 FG-Q8 FG-Q9 FG-Q10	0.8 0.8048 0.8348 0.7778	0.8464
Intention to using the game	Users behavioral intention of using the game	IT-Q3 IT-Q11 IT-Q13 IT-Q14	0.8188 0.796 0.8324 0.8189	0.8562

Bold: Cronbach's Alpha is over .7

Table 10. Final Reliability for Questionnaire Part 2 (TAM) components.

The final validity analysis of the reassigned items appears below. As can be seen, the items now contribute to their assigned factors with a value of .6 or higher.

	1 (PEoU)	2 (PU)	3 (FG)	4 (INT)
PEoU-Q1	.815	.055	.128	.079
PEoU-Q19	.907	.246	-.095	-.056
PEoU-Q21	.692	.263	-.323	-.070
PU-Q2	.566	.617	.231	-.394
PU-Q22	.312	.787	.252	.248
PU-Q23	.209	.913	.094	-.016
FG-Q7	.106	.481	.762	.182
FG-Q8	-.273	-.056	.877	-.085
FG-Q9	.458	.106	.771	-.203
FG-Q10	-.190	.376	.758	.279
INT-Q3	.031	.573	.173	.732
INT-Q11	-.094	.071	.074	.858
INT-Q13	-.162	-.150	.098	.833
INT-Q14	.185	.102	-.194	.857

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Table 11. Final Revision of items in TAM questionnaire.

Usability Questionnaire Reliability and Validity

The second questionnaire completed by the students also had a section dealing with usability. This section is designed to gather information on the participants views on how effective, efficient the game was and satisfied they were with it. The first action is to check the reliability of the questionnaire. In its entirety, the questionnaire scores 0.8438 on Cronbach's Alpha [63]. This questionnaire is in the good range, so it is reliable. The alphas of each of the individual factors are listed below.

Factor	Description	Items	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Effectiveness		Q18 Q19	0.5093 0.5093	<i>0.6747</i>
Efficiency		Q20 Q21 Q22 Q23	0.7274 0.7834 0.6578 0.6371	0.7673
Satisfaction		Q24 Q25 Q26	0.7952 0.4687 0.6519	0.7271

Italics: Cronbach's Alpha value is less than .7

Bold: Cronbach's Alpha is over .7

Table 12. Reliability for Questionnaire Part 2 (Usability) components.

As indicated by the table above, the 'Effectiveness' factor has a low alpha value, and it cannot be increased by removing a question. For this research project, this factor cannot be used. The questions in this factor deal with difficulty using the game. As mentioned earlier, there was a wide range of comments made on the difficulty encountered. It is possible that due to the low number of participants and wide range in responses that this factor is not reliable.

An examination of the remaining factors for validity can be found in the table below. In this table, one item (Question 24) does not fit into the pre-defined category. After checking the question against other questions in the predefined factor (Satisfaction) and other factor (Efficiency), it was determined that the question could be moved.

	Component	
	1 (Efficiency)	2 (Satisfaction)
Efficiency-Q20	.821	-.251
Efficiency-Q21	.605	.142
Efficiency-Q22	.788	.134
Efficiency-Q23	.756	.476
<i>Satisfaction-Q24</i>	<i>.794</i>	<i>.376</i>
Satisfaction-Q25	.192	.896
Satisfaction-Q26	.052	.877

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 Rotation converged in 3 iterations.

Bold: item's factor loading is over 0.6 for the pre-defined component

Bold and underline: item's factor loading for the pre-defined component is less than 0.6

Bold and italic: item's factor loading is over 0.6 for the component other than the pre-defined one

Table 13. Validity Analysis for Usability Questionnaire.

Since the question is being moved to another factor, the Cronbach's alpha for this part of the questionnaire was recalculated. The overall score for the questionnaire is now 0.8201 [63], still in the good range. The individual alpha scores are listed in the table below. As can be seen in this table, moving the questions does not have an effect on the reliability of this part of the questionnaire.

Factor	Description	Items	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Efficiency		Q20	0.8187	0.8327
		Q21	0.8424	

		Q22	0.7852	
		Q23	0.7655	
		Q24	0.7673	
Satisfaction		Q25	0.6459	0.7838
		Q26	0.6459	

Bold: Cronbach's Alpha is over .7

Table 14. Final Reliability for Questionnaire Part 2 (Usability) components.

The final validity of the Usability questionnaire is below. While the Satisfaction factor is comprised of only two questions the values of the two questions is high enough, so this factor will be used in further analysis.

	Component	
	1 (Efficiency)	2 (Satisfaction)
Efficiency-Q20	.821	-.251
Efficiency-Q21	.605	.142
Efficiency-Q22	.788	.134
Efficiency-Q23	.756	.476
Satisfaction-Q24	.794	.376
Satisfaction-Q25	.192	.896
Satisfaction-Q26	.052	.877

Bold: Cronbach's Alpha is over .7

Table 15. Final Validity Analysis for Usability Questionnaire.

Research Model

The main research question to be answered is if the game results in an increase in knowledge of financial concepts. Other questions center on users' attitude towards computer games, technology acceptance and the system's usability. Two moderators are also taken into account – gender and gaming experience.

The questions to be answered by the research include the following:

- Does playing the game result in an increase in the player's knowledge of financial concepts?
- Do the player's attitudes towards games influence his/her attitude to playing?
- Does the systems usability affect player's acceptance of the game?

- Does the freedom in the game encourage or discourage the player?
- Do both genders enjoy the game?
- Does prior gaming experience affect game acceptance?

In the figure below, a macro view of the proposed research model is displayed.

This model shows the high-level view of the proposed research.

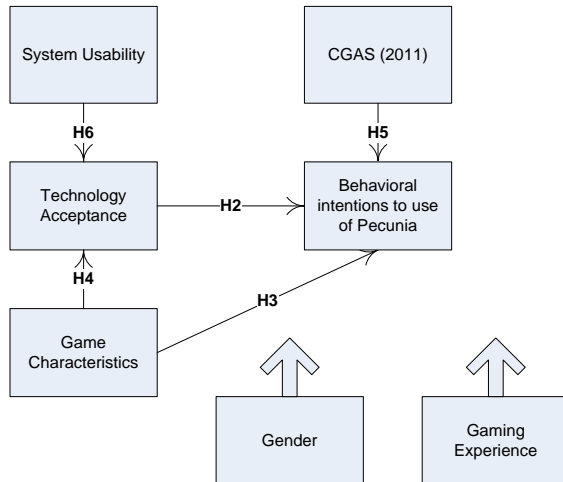


Figure 46. Macro view of proposed research model.

In the diagram below, the detailed research constructs are shown. These constructs only include factors that are available for research. As was indicated by the Reliability and Validity Analysis completed above, not all factors are available for analysis. The factors available for research are listed below.

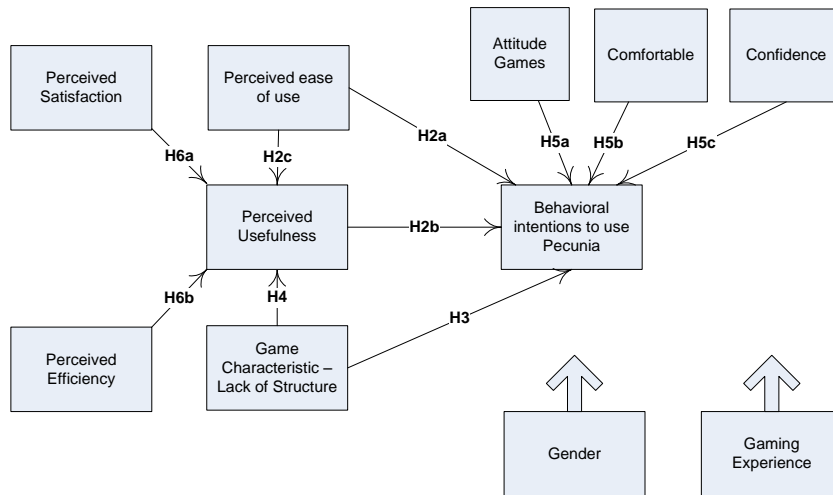


Figure 47. Micro view of proposed research model.

Hypotheses

The tables below contain the hypotheses that need to be verified. The first table lists hypotheses of the TAM. These hypotheses deal with attitudes, perceived ease of use and usefulness and the freedom in the game.

Model	Macro View	Micro View
TAM	H2	H2a: Perceived ease of use has a positive effect in the player's behavioral intentions to use the game.
		H2b: Perceived usefulness has a positive effect on the player's behavioral intentions to use the game.
		H2c: Perceived ease of use has a positive effect on perceived usefulness.
	H3	H3: Freedom in the game has a positive effect on the behavioral intentions to use the game.
	H4	H4: Freedom has a positive effect on perceived usefulness.

Table 16. Hypotheses of the Technology Acceptance Model.

In the table below, the hypotheses for the revised CGAS (CGAS 2011) are listed. These hypotheses will investigate the effect of players' computer and gaming attitudes,

behaviors, level of confidence, liking and comfort with the game. These hypotheses are based on the CGAS model developed by Lu in 2011 [32].

Model	Macro View	Micro View
CGAS	H5	H5a: Attitudes about games have a positive effect on Behavioral Intentions to use the game.
		H5b: Being comfortable has a positive effect on Behavioral Intentions to use the game.
		H5c: Confidence has a positive effect on Behavioral Intentions to use the game.

Table 17. Hypotheses of the revised CGAS (2011) model.

The next table deals with the hypotheses dealing with usability such as effectiveness, efficiency and satisfaction.

Model	Macro View	Micro View
Usability	H6	H6a: Perceived satisfaction of the system has a positive effect on perceived usefulness.
		H6b: Perceived efficiency of the system has a positive effect on perceived usefulness.

Table 18. Hypotheses of systems usability.

Introducing the moderators also introduces hypotheses:

Model	Micro View
Moderators	H7: There is a gender difference on the user's technology acceptance of the game.
	H8: Gaming experience has an effect on the user's technology acceptance of the game.
	H9: There is gender difference on the user's computer game attitude scale.
	H10: There is gaming experience difference on the user's computer game attitude scale.
	H11: There is gender difference on the user's perception of game usability.
	H12: There is gaming experience difference on the perception of game usability.

Table 19. Hypotheses of the moderators introduced.

The primary hypothesis of the research is not measured by the theories and scales mentioned above. To measure this hypothesis, a custom made measurement tool was created – the pre-test and post test. These tests ask a variety of financial questions a person would be required to know and understand. At present there are 20 questions. The player answers the questions before playing the game and then again after playing. Comparing the results allows measurement of learning. The final and most important hypothesis is as follows:

Main Hypothesis
H1: Playing the game has a positive effect on the player’s knowledge of financial matters.

Table 20. Main research hypothesis.

Data Analysis

Before beginning in-depth analysis of the data, a section describes the information gathered. It then does a series of independent t-tests on gender and gaming experience and the effect on Game Acceptance, Technology Acceptance and Usability. These tests are designed to see if there are any statistically significant differences in perceptions between male and female players and between regular and power gamers.

The next section discusses a series of simple regression analysis tests to compare factors against each other. The intent is to see if the Computer Game Attitude Scale and the Technology Acceptance Model factors have a positive effect on the factor ‘Intention to Use the Game’. In addition, a series of tests from the Technology Acceptance Model and Usability factors are performed to determine if there are any positive effects on Perceived Usability.

Descriptive Statistics

The first part of the questionnaire given to students captures some demographic information and experience playing computer and video games. The table below shows a summary of this information.

Gender	N	Play Video Games	Play Computer Games
Male	11	11 (100%)	11 (100%)
Female	5	5 (100%)	4 (80%)
Total	16	16 (100%)	15 (93.75%)

As can be seen by the table above, all participants had played a video game of some sort in their lives. The vast majority of participants also played video games as well. The table below summarizes the hours per week spent playing video games. Note: There are significant differences in the means between male and female players. This caused Levene's Test for Equality of Variances to return a p value <0.05 for both 'Video game only' and 'Computer games only'. As a result, the null hypothesis that there are no differences in standard deviation was rejected. Values listed in the tables below are obtained from the test values for 'equal variances not assumed'.

	Gender	N	Mean (hours per week)	Standard Deviation	T value
Video Games only	M	11	11.318	6.141	-4.808***
	F	5	1.800	1.565	
Computer games only	M	11	9.500	6.888	-4.134**
	F	5	.8000	.758	
Total gaming per week	M	11	20.818	9.785	-4.017**
	F	5	2.600	7.917	

*:p<0.05 **:p<0.01 ***:p<0.001

Table 21. Comparison of game playing time.

From the table above it is easy to see that there is considerable differences between males and females when it comes to playing computer based games, whether they are video console/handheld or computer based games.

The players can also be broken down into subgroups within each category. Due to the limited size of the sample, the top 50% will be considered 'power gamers' while the remaining 50% will be considered 'regular gamers'. Unfortunately, no females make it into the 'power gamers' category due to the limited computer playing that they do.

Grouped By	Groups	N	Mean (Hours/Week)
Gender	M	11	---
	F	5	---
Time spent playing games	Power Gamers	8	24.000
	Regular Gamers	8	6.25

Table 22. Sample sizes of gender and time spent playing games.

The next table lists the descriptive statistical data for the research model. The table lists information for the CGAS, TAM and Usability questionnaires.

	N	Mean	Std. Deviation	Std. Error	Average Mean for Category
CGAS					
Attitude	16	3.6875	.93071	.23268	3.741
Comfortable	16	3.7812	.86542	.21636	
Confidence	16	3.7529	.26418	.06604	
TAM					
Perceived Ease of Use	16	3.4583	.76860	.19215	3.525
Perceived Usefulness	16	3.3750	1.01012	.25253	
Freedom in Game	16	3.5938	.93039	.23260	
Intention	16	3.6719	.90240	.22560	
Usability					
Efficiency	16	3.4250	.81609	.20402	3.884
Satisfaction	16	4.3438	.72385	.18096	

Table 23. Descriptive statistical data of all constructs.

Independent T-Test for CGAS

This section explores whether there are significant differences in the participants computer games attitudes. Three factors are available for analysis, Attitude toward Computer Games, Comfortable and Confidence. The group to be tested is Males vs. Females.

	Gender	N	Mean	Standard Deviation	t value
Attitude Towards Computer Games	Female	5	3.6667	.4714	-.0580
	Male	11	3.6970	1.1001	
Comfortable	Female	5	3.3000	.9906	-1.571
	Male	11	4.0000	.7500	
Confidence+	Female	5	3.7449	.4619	-.0550
	Male	11	3.7565	.1390	

*:p<0.05 **:p<0.01 ***:p<0.001

+: Levene's Test for Equality of Variances failed

Table 24. Gender Differences on factors of CGAS.

As can be seen in the table above, none of the factors show statistically significant differences. Since the differences are not statistically significant, it cannot be stated that there is a difference between males and females in their attitudes towards computer games. As a result, Hypothesis 9 cannot be supported.

The next comparison is the computer game attitude scale based on the computer users gaming experience.

	Game Playing	N	Mean	Standard Deviation	t value
Attitude Towards Computer Games+	Power	8	3.5833	1.2818	-.4350
	Regular	8	3.7917	.4341	
Comfortable	Power	8	3.8750	.8345	.4210
	Regular	8	3.6875	.9426	
Confidence+	Power	8	3.7633	.1545	.1520
	Regular	8	3.7425	.3542	

*:p<0.05 **:p<0.01 ***:p<0.001

+: Levene's Test for Equality of Variances failed

Table 25. Game Experience Difference on Factors of CGAS.

In the table above there are no statistically significant differences in the participants experience playing games. Because there is no difference, Hypothesis 10 cannot be supported.

Independent T-Test for TAM

The same two factors are also used to test the effect on technology acceptance. First we will explore how gender may affect this model.

	Gender	N	Mean	Standard Deviation	t value
Perceived of Use	Female	5	3.6000	.8628	.4840
	Male	11	3.3939	.7574	
Perceived Usefulness	Female	5	3.6667	1.1304	.7680
	Male	11	3.2424	.9785	
Freedom in Game	Female	5	3.9500	.9585	1.0350
	Male	11	3.4318	.9158	
Intention	Female	5	3.0000	1.1319	-2.2680*
	Male	11	3.9773	.6170	

*:p<0.05 **:p<0.01 ***:p<0.001

Table 26. Gender differences on the TAM constructs.

In the table above, one factor shows a significant difference. Between males and females, there seems to be a significant difference in Intention Towards the Game. Although it is only a single factor, it is significant, so Hypothesis H7 is conditionally confirmed.

It is also desirable to know if there is a difference towards technology acceptance based on the players gaming experience. The table below provides these figures.

	Game Playing	N	Mean	Standard Deviation	t value
Perceived of Use	Power	8	3.4583	.8718	0
	Regular	8	3.4583	.7113	
Perceived Usefulness	Power	8	3.2500	1.1374	-.482
	Regular	8	3.5000	.9258	
Freedom in Game	Power	8	3.4688	.8498	-.524
	Regular	8	3.7188	1.0474	
Intention	Power	8	4.0938	.4807	2.063
	Regular	8	3.2500	1.0522	

*:p<0.05 **:p<0.01 ***:p<0.001

Table 27. Gaming differences on TAM constructs.

As can be seen by the values listed above, none of the differences listed above are statistically significant. Because of this, Hypothesis H8 cannot be supported.

Independent T-Test for Usability

Finally, gender and gaming experience are compared to the usability factors to see if any differences exist. The first comparison is using gender.

	Gender	N	Mean	Standard Deviation	t value
Efficiency	Female	5	3.7200	1.0826	.9730
	Male	11	3.2909	.6833	
Satisfaction	Female	5	4.6000	.5477	.9520
	Male	11	4.2273	.7863	

*:p<0.05 **:p<0.01 ***:p<0.001

Table 28. Gender difference on the Usability constructs.

According to the table above, there are not any statistically different values with regard to gender with regard to usability. As a result, Hypothesis 11 cannot be supported.

The participants gaming experience may have an effect on their perceptions of usability. This is explored in the next table.

	Game Playing	N	Mean	Standard Deviation	t value
Perceived of Use	Power	8	3.2250	.7741	-.979
	regular	8	3.6250	.8582	
Perceived Usefulness	Power	8	4.3750	.8763	.167
	regular	8	4.3125	.5939	

*:p<0.05 **:p<0.01 ***:p<0.001

Table 29. Game experience on the usability constructs.

Like gender, the participants gaming experience is not statistically significant, so it does not seem to have any effect on perceived usability. As a result, Hypothesis 12 cannot be supported.

Linear Regression Analysis

In an attempt to determine how factors relate to one another, a series of linear analysis tests were performed. The primary intent was to determine if factors had a positive effect on either Intention to Use the Game or Perceived Usefulness. The results of the linear regression for factors affecting Intent to Use the Game appear below. Factors tested to see if they affected Intent to use the game include those from the Computer Game Attitude Scale and the Technology Acceptance Model.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
CGAS							
Attitude towards Computer Games	-.043	.259	-.044	-.166	.871	1.000	1.000
Comfortable	.398	.258	.382	1.547	.144	1.000	1.000
Confidence	-1.269	.848	-.372	-1.497	.156	1.000	1.000
TAM							
Perceived Ease of Use	-.011	.314	-.009	-.034	.974	1.000	1.000
Perceived Usefulness	.112	.237	.126	.474	.643	1.000	1.000
Freedom in the Game	.129	.257	.133	.504	.622	1.000	1.000

*:p<0.05 **:p<0.01 ***:p<0.001

Dependent Variable: Intention

Table 30. Effect of CGAS and TAM Factors on Intention to Play the Game.

As can be seen by the table above, none of the factors have a significant enough effect on Intention to Play the Game. As a result, the following Hypotheses cannot be supported: H2a, H2b, H3, H5a, H5b, H5c.

In the table below, factors that affect Perceived Usefulness are listed.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
TAM							
Perceived Ease of Use	.693	.298	.527	2.231	.036*	1.000	1.000
Freedom in Game	.457	.263	.421	1.738	.104	1.000	1.000
Usability							
Satisfaction	.534	.344	.389	1.582	.136	1.000	1.000
Efficiency	1.126	.137	.910	8.202	.000***	1.000	1.000

*:p<0.05 **:p<0.01 ***:p<0.001

Dependent Variable: Perceived Usefulness

Table 31. Effects of TAM and Usability factors on Perceived Usefulness.

In this table there are two factors with significant positive effects on Perceived Usefulness. The first is Perceived Ease of Use. It appears that participants who believed the game to be easy to use also believed the game was useful. From a logical perspective this makes sense since something that is easy to use is often perceived as being useful. Because of the positive, statistically significant effect, Hypothesis H2c can be confirmed.

Another strong factor that positively affects Perceived Usefulness is Efficiency. Participants who saw the game as being efficient also believed the game was useful. Once again, from a logical perspective, this makes sense. If something is considered efficient it is also considered useful. As a result, Hypothesis H2b can be confirmed.

The remaining two factors do not show statistically significant differences. It was hoped that the design of the game, in particular the freedom given to players to play as

they liked, would have an effect on their perceived usefulness. According to the results, this does not seem to be the case. As a result, Hypothesis H4 cannot be supported.

The remaining factor, satisfaction, also does not seem to have a statistically significant effect on Perceived Usability. As a result, Hypothesis H6a is not supported.

Paired Samples T-Test for Pre-test and Post-test

The hypothesis of primary interest is the results of playing the game, namely, did participants learn anything from playing. Learning is being measured using a repeated measures design. The repeated measures are the pre-test and post-test taken by participants. The pre-test measured knowledge before the player began the game. Upon completion of playing, the post test was taken to measure how much was learned by the participant. The table below lists the descriptive statistics for the results of the tests.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test	72.5000	16	26.14065	6.53516
	Post Test	83.4375	16	16.30120	4.07530

Table 32. Descriptive Statistics of Pre-Test and Post-test results.

As indicated in the table above, the mean of the post-test is almost 11% higher than the pre-test. While this seems like a significant increase, a paired samples test was done to measure the exact effect. The results of this test are below.

	Paired Differences			T value
	Mean	Std. Deviation	Std. Error	
Pre-Test – Post-test	-10.9375	20.2665	5.0666	-2.159*

*:p<0.05 **:p<0.01 ***:p<0.001

Table 33. Paired Samples Test Result for the Pre-Test and Post-Test.

As indicated in the table above, there is a significant difference in the scores for participants on the pre-test and post-test. This indicates that the game succeeded in its

purpose of increasing the knowledge of participants in financial matters. As a result, Hypothesis 1 is confirmed.

Hypotheses:

	No.		Result	Page
H1	H1	Playing the game has a positive effect on the player's knowledge of financial matters.	Confirmed	
H2	H2a:	Perceived ease of use has a positive effect in the player's behavioral intentions to use the game.	Not Supported	
	H2b:	Perceived usefulness has a positive effect on the player's behavioral intentions to use the game.	Not Supported	
	H2c:	Perceived ease of use has a positive effect on perceived usefulness.	Confirmed	
	H3:	Freedom in the game has a positive effect on the behavioral intentions to use the game.	Not Supported	
	H4:	Freedom has a positive effect on perceived usefulness.	Not Supported	
	H5a:	Attitudes about games have a positive effect on Behavioral Intentions to use the game.	Not Supported	
	H5b:	Being comfortable has a positive effect on Behavioral Intentions to use the game.	Not Supported	
	H5c:	Confidence has a positive effect on Behavioral Intentions to use the game.	Not Supported	
	H6a:	Perceived satisfaction of the system has a positive effect on perceived usefulness.	Not Supported	
	H6b:	Perceived efficiency of the system has a positive effect on perceived usefulness.	Confirmed	
	H7:	There is a gender difference on the user's technology acceptance of the game.	Conditional; Intention only	
	H8:	Gaming experience has an effect on the user's technology acceptance of the game.	Not Supported	
	H9	There is gender difference on the user's computer game attitude scale.	Not Supported	
	H10	There is gaming experience difference on the user's computer game attitude scale.	Not Supported	
	H11	There is gender difference on the user's perception of game usability.	Not Supported	
	H12	There is gaming experience difference on the perception of game usability.	Not Supported	

Table 34. Hypotheses and Analysis results

Final Testing Thoughts

The changes required by the Review Ethics Board (REB) made testing the game somewhat challenging, and ultimately affected the expected test results generated. I was hoping to be able to prove that it was feasible to develop a game/simulation to teach younger students the importance of financial knowledge. Since I was not able to use the test subjects first proposed, I used volunteers from a variety of sources. These volunteers, although willing and eager to participate in the test, often did not fit into the target audience the game was designed to educate. While some of the results were positive, most hypotheses suggested could not be proven.

While I cannot say for certain that the project was a success, there were a few highlights. The biggest is being able to prove the primary hypothesis that the game helps educate players on financial matters. Being able to prove this indicates to me that the game is viable. I also had a few concerns on the playability of the game before testing began. I was concerned that players might not like the interface, game play and so on. While many of the hypotheses suggested to measure these features could not be proven, in general, feedback was positive. I firmly believe that another test with a larger and longer test period may help generate better results for all suggested hypothesis.

I also believe that the game may be beneficial to age groups other than the target age of grade 6. Roughly 62% of the participants were children, ranging in age from 11 through 18. There were students in grades 6 through 12. All student participants stated they enjoyed playing the game, and said it helped them understand basic financial matters better. Looking at individual test scores generated, most students (80%) showed an increase in the post-test score compared to the pre-test score. The test data

seems to confirm their personal observations, the game is successful. Regardless of the actual grade the students were in, the majority believe the game helped them understand finances better.

The game did not seem to be as successful with the adult group. Of the group, only about 37% were adults. Since this number is so low, it is difficult to make any firm observations, but general trends could be mentioned. Most adults found the game difficult to play at times. I believe this was a lack of patience on the part of the adults as items complained about by the adult group were not mentioned by the students, or the students considered these parts of the game to be OK.

Looking at the pre-test and post-test scores for the adults shows that the adult group did not improve as much as the children. Only 66% of the adults showed an improvement in the post-test, and the improvement was minimal for those that did. I believe that this is due to the adults already having a good understanding of basic finances.

An interesting avenue of study would be to have a large group of participants in a variety of age ranges play the game for the intended duration (30 days). At the end of the test, analyze the data based on age and grade and note any differences. It would also be beneficial as it could be determined if there is a 'sweet spot' at which the financial education seems to fit best. This would allow the game to be developed more accurately for the best age group.

CHAPTER VI

Summary and Future Work

Summary

The Pecunia game is a massively multiplayer online role playing game (MMORPG) designed to teach children financial concepts they will need as adults. Students playing the game have an avatar living in a virtual world and are expected to help their avatar live a financially secure, comfortable life. The object of the game is for the avatar to reach retirement age (65 years old) with enough money and belongings that the avatar can retire.

Players start the game as an 18 year old with the clothes on their backs and \$1,000 in cash. During their avatar's life they need to find a place to live, get a job and maintain their avatars health. They can choose to go to school to improve their education and get better jobs, or can work to get experience and job promotions. A series of random events can affect the player's avatar. These events include becoming sick, being fined, having personal items stolen and so on. A primary feature of the game is the freedom afforded to players. There is not a strict set of 'missions' or 'levels' of play. Players are encouraged to explore the game at their own speed.

The system was developed using client-server based software. The server contains the virtual world where the avatar actually lives while the client portion provides the interface to the server for game players. The system was tested using the target audience of grade 6 students (as much as was practical and possible). Some adults also took part in testing the game.

The research findings determined that the game was successful at teaching participants financial concepts. While this hypothesis was proven, most others were rejected. The reason for rejection might have been due to the relatively low number of participants (16 in total), and the composition of the group (adults and children). In addition, it was realized during analysis that the female game playing component was considerably lower than was hoped.

The intent of the game was to be delivered in a grade 6 classroom by a teacher. It was hoped that the game could be used as a learning tool by the teacher to stress the importance of financial topics to the children. For the test, this part was not used. Students enrolled themselves in the game and played on their own without direction. If used as first envisioned, the outcomes may have been even more positive.

Another factor that affected the game was the testing period. The actual game is designed to run for 30 days. For the duration of the test, players only played for 10 days. It was decided that a 30 day test period would be too long, and may prevent players from volunteering or could have resulted in a high drop-out rate.

Future Work

The game is a new approach to teaching finances. As a result, there are not a lot of other games to compare to. Possible ways to improve the game could include:

1. The financial concepts covered in the game are those identified by a variety of sources discussed earlier. It is likely that some financial items were omitted. More research into financial concepts could make the game a more valuable learning experience.

2. In subsequent game releases more research may need to be done into what financial items are considered more important than others. In the first release all financial concepts are treated equally. This is likely not the case, so more research into identifying the most important concepts should be done.
3. The current game flow depends heavily on user choice. It is possible that a player could go through the game without ever experiencing a particular financial event (getting a credit card for example). Subsequent releases should have some process in place that requires certain financial choices to be made without taking the control away from the player.
4. The game's financial world is based on stability and lacks inflation and recession factors. Introducing these factors would help students better understand how their financial decisions are affected by forces outside their control.
5. The pretest and posttest used to measure learning by the teacher are based on North American financial standards. These standards may not apply in other regions of the world. Giving the teacher the opportunity to revise these tests for their classes may improve their students learning experience.
6. The game is based on an average, middle class, healthy Canadian student. There is no allowance for students in higher or lower classes, or disabled students who may need to live their lives differently than what is available in the world. Allowing for different types of students would reach a larger student audience.

7. There is no concept of charity in the game, a player's avatar is only working towards their own retirement without concern for others in the game. Adding in a social component may make the game more challenging as the player needs to work to have their avatar retire, plus make the virtual world a safer place to live. This could be accomplished by offering opportunities for the player to participate in social activities, contribute to charities, etc.
8. The game dictates what successful retirement is. There is no way for the student to specify what they believe as successful retirement. Allowing the student to choose or set parameters to be met may make the game more enjoyable.
9. Although students can communicate and work together in a limited fashion, the opportunities for collaboration are limited. Expanding what they can do together would make the game more interesting.

After playing the game, several comments were received from participants.

These comments offered suggestions from the user's perspective on how to make the game better. These comments include the following:

- Several comments focused around the length of the test. Some of the participants were only just starting to understand how the game worked when their avatar was retired. More time to play the game would have been nice.
- Several participants indicated that they would have preferred some sort of direction in playing the game. Many mentioned that having the game played in a classroom under the direction and guidance of the teacher would have been nice.

- Some of the interface items were not popular. In particular, some error messages encountered displayed only briefly on the screen. It was easy to miss these messages, or not have enough time to read them in their entirety. Having these messages appear in a different format or appear longer would be beneficial.
- Certain dialogs did not seem to work well. In particular, the 'Purchase Home' and 'Deliver Groceries' dialogs were difficult to use. This was a limitation of the abilities of the software. Correcting these issues would be a major undertaking.
- Many participants did not like the random fine process. The process does not indicate why the avatar was being fined, just that they were. Most found this frustrating and would have preferred being told why the fine was being applied (even if it was not for a good reason).
- Some participants wanted more challenges in the game. At present the game design is very free flow, requiring little effort to succeed if the game is approached the right way. Optional challenges would have made the game more interesting for some of the participants.

If development is to continue on the game then several factors should be taken into account.

- The software used has several limitations. These were encountered during development and prevented implementation of some of the items originally planned.

- The software used also has several known bugs that affect performance and other options that are not implemented.
- While the client-server model seemed to work well, there was considerable network traffic between the clients and server. It is suggested that a single server not exceed 40 avatars at a time, and this was before the necessary changes for the game were introduced. With the extra processing added, this number might be even lower. During development and testing there was not an opportunity to stress test the system. This should be considered in the future.
- Consideration could be made to using a different game engine. The engine used (Opensim) is open source. While it does function satisfactorily and there is a support group, this support can be slow and bugs may never be fixed.

REFERENCES

- [1] American Savings Education Council. (1999). Youth & money 1999: Results of the 1999 youth and money survey. Retrieved August 13, 2010, from http://www.tiaa-crefinstitute.org/pdf/research/speeches_papers/ym_fullrpt.pdf
- [2] Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2009). Students' perceptions about the use of video games in the classroom. *Computers & Education, 54*(4), 1145-1156.
- [3] Calapp, M. (2002). Children's personal finance - teaching kids about money. eSSORTMENT. Retrieved August 13, 2010, from http://www.essortment.com/all/childeducation_rxju.htm.
- [4] Chappell, K. K., Taylor, C. S. (1997). Evidence for the Reliability and Factorial Validity of the Computer Game Attitude Scale. *Journal of Educational Computing Research, 17*(1), 67-77.
- [5] Cheng, H. N.-H., Deng, Y.-C., Chang, S.-B., & Chan, T.-W. (2007). Edubingo: Design of Multi-level Challenges of a Digital Classroom Game. In *the Proceedings of the First IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning*, (DIGITEL 2007), Jhongli, Taiwan, March 26-28, 2007, 11-18.
- [6] Cheung, K., Jong, M., Lee, F., Lee, J., Luk, E., Shang, J., & Wong, M. (2008). FARMTASIA: an online game-based learning environment based on the VISOLE pedagogy. *Virtual Reality, 12*(1), 17-25.

- [7] Chodkiewicz, A., Johnston, B., Sunders, S., & Yasukawa, K. (2005). Educating Parents: The Evenstart financial literacy program, *Literacy and Numeracy Studies*, 14(1), 33-47. Retrieved August 13, 2010, from <http://www.uts.edu.au/fac/edu/research2/archives/pdfs/ESArticle.pdf>
- [8] Cole, S., & Niles, F. (2008). Assessing the Importance of Financial Literacy. *Finance for the Poor*, 9(3). Retrieved August 13, 2010, from <http://www.adb.org/Documents/Periodicals/Microfinance/finance-200803.pdf>
- [9] Contract Bridge. (2010). Wikipedia. Retrieved August 13, 2010, from http://en.wikipedia.org/wiki/Contract_bridge
- [10] Cooperberg, C. (2009, April 21). Teaching children about money. *The Globe and Mail*. Retrieved August 13, 2010, from <http://www.theglobeandmail.com/globe-investor/personal-finance/home-cents/teaching-children-about-money/article986228/>
- [11] Cribbage. (2010). Wikipedia. Retrieved August 13, 2010, from <http://en.wikipedia.org/wiki/Cribbage>
- [12] Cude, B. J., Lawrence, F. C., Lyons, A. C., Metzger, K., LeJeune, E., Marks, L., & Machtmes, K. (2006). College Students and Financial Literacy: What They Know and What They Need to Learn. In *the Proceedings of the Eastern Family Economics & Resource Management Association (EFERMA) Biannual Conference*, Knoxville, Tennessee, USA, February 23-25, 2006, 102-109. Retrieved August 13, 2010, from <http://mrupured.myweb.uga.edu/conf/22.pdf>
- [13] Danes, S., Huddleston-Casas, C., & Boyce, L. (1999). Financial Planning Curriculum For Teens: Impact Evaluation. *Journal of Financial Counseling and Planning*, 10(1), 26-39.

- [14] DiPietro, M., Ferdig, R., Boyer, J., & Black, E. (2007). Towards a Framework for Understanding Electronic Educational Gaming. *Journal of Educational Multimedia and Hypermedia*, 16(3), 225-248.
- [15] Dowling, J. (2005). How to teach children about money. *Notebook Magazine*. Retrieved August 13, 2010, from <http://www.homelife.com.au/money+finance/42/how+to+teach+children+about+money>
- [16] Egenfeldt-Nielsen, S. (2007). Third generation educational use of computer games. *Journal of Educational Multimedia and Hypermedia*, 16(3), 263-281.
- [17] Eow, Y. L., Ali, W. Z. W., Mahmud, R., & Baki, R. (2009). Form one students' engagement with computer games and its effect on their academic achievement in a Malaysian secondary school. *Computers & Education*, 53(4), 1082-1091.
- [18] Epand, V. (n.d.). Skills Learned by Children Who Play Chess. *Ezine Articles*. Retrieved August 13, 2010, from <http://ezinearticles.com/?Skills-Learned-by-Children-Who-Play-Chess&id=1804873>
- [19] Feslier, D. (2006). Financial Education and Financial Literacy in New Zealand. In *the Proceedings of the OECD Conference on Financial Education*, New Delhi, India, September, 21-22, 2006. Retrieved August 13, 2010, from <http://www.oecd.org/dataoecd/15/53/37424633.pdf>
- [20] Fox, J., Bartholomae, S., & Lee, J. (2005). Building the case for Financial Education. *The Journal of Consumer Affairs*, 39(1), 195-214.

- [21] Fu, F., & Yu, S-C. (2006). The Games in E Learning Improve the Performance. In *the Proceedings of the 7th International Conference on Information Technology Based Higher Education and Training, (ITHET '06)*, Sydney, Australia, July 10-13, 2006, 732-738.
- [22] Go Fish. (2010). Wikipedia. Retrieved August 13, 2010, from http://en.wikipedia.org/wiki/Go_fish
- [23] Greenspan, A. (2005). The importance of financial education today. *Social Education*, 69(2), 64.
- [24] Gros, B., & Garrido, J. (2008). The Use of Videogames to Mediate Curricular Learning. In *the Proceedings of the Second IEEE International Conference on Digital Games and Intelligent Toys Based Education*, Banff, Alberta, Canada, November 17-19, 2008, 170-176.
- [25] Holden, K., Kalish, C., Scheinholtz, L., Dietrich, D., & Bovak, B. (2009). Financial Literacy Programs Targeted on Pre-School Children: Development and Evaluation. *University of Wisconsin - Madison*. Retrieved August 13, 2010, from <http://minds.wisconsin.edu/bitstream/handle/1793/36314/holden2009-009.pdf?sequence=1>
- [26] Hong, J-C., Cheng, C-L., Hwang, M-Y., Lee, C-K., & Chang, H-Y. (2009). Assessing the educational values of digital games. *Journal of Computer Assisted Learning*, 25(5), 427-437.

- [27] Hsiao, H-C. (2007). A Brief Review of Digital Games and Learning. In *the Proceedings of the First IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning*, (DIGITEL 2007), Jhongli, Taiwan, March 26-28, 2007, 124-129.
- [28] Ibrahim, R., Khalil, K., & Jaafar, A. (2011). Towards Educational Games Acceptance Model (EGAM): A Revised Unified Theory of Acceptance and Use of Technology (UTAUT). *International Journal of Research and Reviews in Computer Science (IJRRCS)*, 2(3), 839-846.
- [29] Jang, Y., & Ryu, S. (2009). Exploring Game Leadership and Online Game Community. In *the Proceedings of the Conference in Games and Virtual Worlds for Serious Application*, (VS-GAMES 2009), Coventry, England, March 23-24, 2009, 178-181.
- [30] Johnson, E., & Sherraden, M. S. (2007). From Financial Literacy to Financial Capability Among Youth. *Journal of Sociology & Social Welfare*, 34(3), 119-146.
- [31] Kebritchi, M., Hirumi, A., & Bai, H. (2010). The effects of modern mathematics computer games on mathematics achievement and class motivation. *Computers & Education*, 55(2), 427-443.
- [32] Lu, C. (2012). Story Decorated Context-Awareness Role Playing Learning Activity Generation. Unpublished Master Thesis, Athabasca University, Athabasca, Canada.

- [33] Lu, C., Chang, M., Kinshuk, Huang, E., & Chen, C.-W. (2011). Usability of Context-Aware Mobile Educational Game. *Knowledge Management & E-Learning*, 3(3), 448-477. Retrieved on October 13, 2011, from <http://www.kmel-journal.org/ojs/index.php/online-publication/article/view/129/107>
- [34] Lusardi, A., & Mitchell, O. (2007). Financial literacy and retirement preparedness: evidence and implications for financial education; The problems are serious, and remedies are not simple. *Business Economics*, 42(1) 35-44. Retrieved August 13, 2010, from http://www.wiserwomen.org/pdf_files/research/2007_research.pdf
- [35] Lusardi, A., Mitchell, O., & Curto, V. (2009). Financial Literacy among the Young: Evidence and Implications for Consumer Policy. *The National Bureau of Economic Research*, NBER Working Paper No. 15352. Retrieved August 13, 2010, from http://www.dartmouth.edu/~alusardi/Papers/Financial_literacy_young.pdf
- [36] Mandell, L. (2006). Teaching young dogs old tricks: The effectiveness of financial literacy intervention in pre-high school grades. In *the Proceedings of the Academy of Financial Services Annual Conference*, Salt Lake City, UT, USA, October 11, 2006. Retrieved August 13, 2010, from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.128.2740&rep=rep1&type=pdf>
- [37] Mandell, L., & Klein, L.S. (2007). Motivation and Financial Literacy. *Financial Services Review*, 16(2), 105-116. Retrieved August 13, 2010, from http://www2.stetson.edu/fsr/abstracts/vol_16_num2_p105.PDF

- [38] Mandell, L. (2009). The Impact of Financial Education in High School and College on Financial Literacy and Subsequent Financial Decision Making. In *the Proceedings of the 2009 American Economic Association Conference*, San Francisco, CA, USA, January 3-5, 2009. Retrieved August 13, 2010, from http://www.aeaweb.org/annual_mtg_papers/2009/retrieve.php?pdfid=507
- [39] Mandell, L., & Klein, L.S. (2009). The impact of Financial Literacy Education on Subsequent Financial Behavior. *Journal of Financial Counseling and Planning*, 20(1), 15-24. Retrieved August 13, 2010, from http://6aa7f5c4a9901a3e1a1682793cd11f5a6b732d29.gripelements.com/pdf/lewis_mandell_linda_schmid_klein.pdf
- [40] Martin, V. (2008). Online Videogames in an Online History Class. In *the Proceedings of the Second IEEE International Conference on Digital Games and Intelligent Toys Based Education*, Banff, Alberta, Canada, November 17-19, 2008, 146-148.
- [41] McCormack, K. (2007, Mar 22). The Five Rules of Money for Children. *Bloomberg Businessweek*. Retrieved August 13, 2010, from http://www.businessweek.com/investor/content/mar2007/pi20070322_857221.htm
- [42] McCormick M. H. (2009). The Effectiveness of Youth Financial Education: A Review of the Literature. *Journal of Financial Counseling and Planning*, 20(1), 70-83. Retrieved August 13, 2010, from http://6aa7f5c4a9901a3e1a1682793cd11f5a6b732d29.gripelements.com/pdf/martha_henn_mccormick.pdf

- [43] Noor Azli, M., Nor Azan, M., & Shamsul Bahri, C. (2008). Digital games-based learning for children. In *the Proceedings of the International Symposium on Information Technology*, (ITSim 2008), Kuala Lumpur, Malaysia, August 26-29, 2008, 1-6.
- [44] O'Connor, D., & Menaker, E; (2008). Can Massively Multiplayer Online Gaming Environments Support Team Training? *Performance Improvement Quarterly*, 21(3), 23-41. Retrieved August 13, 2010, from <http://www.idsi.com/downloader/download.aspx?fileID=781>
- [45] Orman, S. (2010). How to Teach Your Kids About Money. *Yahoo Finance*. Retrieved August 13, 2010, from <http://biz.yahoo.com/pfg/e37children/>
- [46] Orton, L. (2007). *Financial Literacy: Lessons from International Experience*. Canadian Policy Research Networks Research Report. Retrieved August 13, 2010, from http://www.cprn.org/documents/48647_EN.pdf
- [47] Pachner, J. (2008, March 24). Teaching youngsters about managing money. *CBC News*. Retrieved August 13, 2010, from <http://www.cbc.ca/news/background/personalfinance/kids.html>
- [48] Papastergiou, M. (2009). Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation *Computers & Education*, 52(1), 1-12.
- [49] Paraskeva, F., Mysirlaki, S., & Papagianni, A. (2010). Multiplayer Online Games as Educational Tools: Facing New Challenges in Learning. *Computers & Education*, 54(2), 498-505.

- [50] Personal Finance Education Group. (2009). Teaching children about finance. *Education Business*, 14(6), 52. Retrieved August 13, 2010, from <http://issuu.com/karlosullivan/docs/eb14.6>
- [51] Powell, E. A. (2004, Apr 11). Parents can teach children about personal finance. *The Item*, pp 1D, 2D. Retrieved August 13, 2010, from <http://news.google.com/newspapers?nid=1980&dat=20040410&id=T3MyAAAAIBAJ&sjid=G68FAAAAIBAJ&pg=2450,1540702>
- [52] Rummy. (2010). Wikipedia. Retrieved August 13, 2010, from <http://en.wikipedia.org/wiki/Rummy>
- [53] Russell, R., Brooks, R., & Nair, A. (2006). *Evaluation of the Youth Financial Literacy Trial Program*. RMIT University. Retrieved August 13, 2010, from http://anzprimeaccess.com/Documents/OLI/PeterLalorSecCoITrialeval_RMIT.pdf
- [54] Sung, J.-Y., Levisohn, A., Song, J.-W., Tomassetti, B., & Mazalek, A. (2007). Shadow Box: an interactive learning toy for children. In *the Proceedings of the First IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning*, (DIGITEL 2007), Jhongli, Taiwan, March 26-28, 2007, 206-208.
- [55] Tang, S., Hanneghan, M., & Rhalibi, A. E. (2009). Introduction to Game Based Learning. In T. Connolly, M. Stansfield, & L. Boyle (Eds.), *Games-Based Learning – Advancements for Multi-Sensory Human Computer Interfaces*. IGI Global.

- [56] Toussaint-Comeau, M., & Rhine, S. (2002). Delivery of Financial Literacy Programs. *Journal of Consumer Education*, 19/20, 9-17. Retrieved August 13, 2010, from http://www.cefe.illinois.edu/JCE/archives/2001_2002_vol_19_20/Comeau%20Rhine%2020012002.pdf
- [57] Truong, A. (2010, Apr 27). Don't wait to teach kids about finance. *The Seattle Times*. Retrieved August 13, 2010, from http://seattletimes.nwsourc.com/html/living/2011714108_dollarteach27.html?syndication=rss
- [58] Tuzun, H., Yilmaz-Soylu, M., Karakus, T., Inal, Y., & Kizilkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Computers & Education*, 52(1), 68-77.
- [59] Virvou, M., & Katsionis, G. (2008). On the Usability and Likeability of Virtual Reality Games for Education: The Case of VR-ENGAGE. *Computers & Education*, 50(1), 154-178.
- [60] Vital, D. (2010, April 21). Fall River Public Library, BankFive host program to teach children about finances. *The Herald News*. Retrieved August 13, 2010, from <http://www.heraldnews.com/news/education/x749211352/Fall-River-Public-Library-BankFive-host-program-to-teach-children-about-finances>
- [61] Voulgari, I., & Komis, V. (2008). Massively Multi-user Online Games: The Emergence of Effective Collaborative Activities for Learning. In *the Proceedings of the Second IEEE International Conference on Digital Games and Intelligent Toys Based Education*, 2008. Banff, Alberta, Canada, November 17-19, 2008, 132-134.

- [62] War (Card Game). (2010). Wikipedia. Retrieved August 13, 2010, from [http://en.wikipedia.org/wiki/War_\(card_game\)](http://en.wikipedia.org/wiki/War_(card_game))
- [63] Wessa P. (2010). Cronbach alpha (v1.0.1) in Free Statistics Software (v1.1.23-r7), Office for Research Development and Education, URL http://www.wessa.net/rwasp_cronbach.wasp/
- [64] Wilson, K. A., Bedwell, W. L., Lazzara, E. H., Salas, E., Burke, C. S., Estock, J. L., Orvis, K. L., & Conkey, C. (2009). Relationships Between Game Attributes and Learning Outcomes: Review and Research Proposals. *Simulation & Gaming*. 40(2), 217-266.
- [65] Zin, N., & Yue, W. (2009). History educational games design. In *the Proceedings of the International Conference on Electrical Engineering and Informatics (ICEEI '09)*, Selangor, Malaysia, August 5-7, 2009, 269-275.

APPENDIX A

Pre-Test/Post-Test Questions

1. Does the job you have affect how much money you can make?
 - a. Yes
 - b. No
2. If you want to buy a car but don't have enough money, what could you get from a bank to help you pay for it?
 - a. A credit card
 - b. A personal loan
 - c. A mortgage
3. What is a mortgage?
 - a. When someone loans you money to buy a car
 - b. When someone loans you money to buy furniture
 - c. When someone loans you money to buy a house
4. If you buy something using a credit card, when should the credit card company be paid back?
 - a. It doesn't matter
 - b. Whenever you have the full amount you need to pay back in the bank
 - c. As soon as possible

5. What is interest?
 - a. A lump sum charged for borrowing money
 - b. An amount of money you are charged for borrowing money, based on the initial amount borrowed
 - c. An amount of money you are charged for borrowing money, which changes as the amount you still owes decreases
6. What will cost you more in the long run when you buy an item?
 - a. A credit card
 - b. A personal loan
 - c. A mortgage
 - d. It depends on the amount of money, interest rate and length of time
7. What is the purpose of insurance?
 - a. To get money for items insured when they are lost, stolen or broken
 - b. To be able to replace items with the exact same item when the item is lost, stolen or broken
 - c. To be able to replace an item with a similar one when it is lost, stolen or broken
8. Why should you start saving for retirement right away?
 - a. You need money to live on once you stop working
 - b. The sooner you start saving money the more you will have to retire on
 - c. Existing retirement plans may not be around when you retire
 - d. All of the above

9. What is rent?

- a. An amount of money paid to someone that allows you to live in an apartment or home.
- b. What you pay when you get a mortgage
- c. What you pay when you have a personal loan

10. What is the difference between rent and a mortgage?

- a. You always pay rent, mortgage payments can end
- b. You always pay a mortgage, rent payments can end
- c. Nothing

11. What happens when you cannot pay your bills?

- a. Nothing - you can skip payments anytime
- b. You might lose the item you cannot make a payment on
- c. Whoever loaned you the money to purchase the item will take that item back

12. When can you use a debit card?

- a. When you have money in your bank account
- b. Anytime, regardless of whether you have money in your account or not
- c. Only if your bank account is empty

13. When can you use a credit card?

- a. When you have money in your bank account
- b. Anytime, regardless of whether you have money in your account or not
- c. Only when your bank account is empty

14. What is the difference between a credit card and a debit card?

- a. A debit card lets you pay for items by taking the money out of your account while a credit card loans you the money to make the purchase
- b. A credit card lets you pay for items by taking the money out of your account while a debit card loans you the money to make the purchase
- c. There is no difference

15. What is a wage?

- a. An amount of money you are paid per hour for working
- b. An amount of money you are paid per week or month for working

16. What is a salary?

- a. An amount of money you are paid per hour for working
- b. An amount of money you are paid per week or month for working

17. What is the difference between a wage and a salary?

- a. When paid by wage, the more you work the more you make
- b. When paid by salary, the more you work the more you make
- c. There is no difference

18. What is tax?

- a. Another name for rent
- b. Another name for interest
- c. Money paid to the government

19. Can a person earn a good living if they do not go to college or university?

- a. Yes
- b. No

20. What happens to your pay if you are unable to work for any reason?

- a. It continues uninterrupted
- b. If you don't work you don't get paid
- c. Pay will continue unless you get sick
- d. It may or may not continue, depending on the reason.

APPENDIX B

Pre-Test/Post-Test Questions Answer Key

1. Does the job you have affect how much money you can make?
 - Yes
2. If you want to buy a car but don't have enough money, what could you get from a bank to help you pay for it?
 - A personal loan
3. What is a mortgage?
 - When someone loans you money to buy a house
4. If you buy something using a credit card, when should the credit card company be paid back?
 - As soon as possible
5. What is interest?
 - An amount of money you are charged for borrowing money, which changes as the amount you still owes decreases
6. What will cost you more in the long run when you buy an item?
 - It depends on the amount of money, interest rate and length of time
7. What is the purpose of insurance?
 - To be able to replace an item with a similar one when it is lost, stolen or broken
8. Why should you start saving for retirement right away?
 - All of the above

9. What is rent?

- An amount of money paid to someone that allows you to live in an apartment or home.

10. What is the difference between rent and a mortgage?

- You always pay rent, mortgage payments can end

11. What happens when you cannot pay your bills?

- You might lose the item you cannot make a payment on

12. When can you use a debit card?

- When you have money in your bank account

13. When can you use a credit card?

- Anytime, regardless of whether you have money in your account or not

14. What is the difference between a credit card and a debit card?

- A debit card lets you pay for items by taking the money out of your account while a credit card loans you the money to make the purchase

15. What is a wage?

- An amount of money you are paid per hour for doing some sort of work

16. What is a salary?

- An amount of money you are paid per week or month for working

17. What is the difference between a wage and a salary?

- When paid by wage, the more you work the more you make

18. What is tax?

- Money paid to the government

19. Can a person earn a good living if they do not go to college or university?

- Yes

20. What happens to your pay if you are unable to work for any reason?

- If you don't work you don't get paid

APPENDIX C

Parent Informational letter

This is the informed consent letter to be sent to the parents of volunteers. Instructions in this letter ask the parents to review the letter with their children before they volunteer.

Hello, my name is David Jones. I am a graduate student at Athabasca University enrolled in the Masters of Science in Information Systems program. I am asking you to allow your child help me test the 'Massively Multiplayer Online Role Playing Game for Teaching Youth Finance' I've developed.

The game is designed to be fun to play and to teach players the importance of wise financial management. In the game your child will have an avatar that lives a life under their control. They are responsible for making this avatar live a comfortable, financially secure life. The intent of the game is to have the avatar reach retirement age, 65, with enough money and belongings so that it can retire.

To begin, your child will need to go to a web page and register to play the game. The registration process takes about 10 minutes. Once you have registered, your child must sign on to the game web site and take a pre-test that asks a few questions on financial topics. This test is quick, likely only a few minutes. This will give me an idea of how much they already know. The software is installed on the computers in the school already. You can also download the game software from the game web site and install it on your home computer.

The game will last about 10 days from the first time they start the game until the avatar reaches retirement age. During this time your child can play as much or as little as they like. When your child first starts playing they need to learn how to keep their avatar fed. This may take a while. Once your child has their avatar fed properly, they don't need to check as often. Your child should check at least once a day as events in the game world can effect what your child did earlier. Your child's avatar should be checked at least once per day. This will likely take about 5 minutes or so. The more often they are checking their avatar the better. Once your child starts playing their avatar is aging. During this 10 day period it is experiencing life events. If not checked often enough the avatar can become sick and wind up in hospital, or land in jail and so on. Checking frequently allows your child to make sure the avatar is healthy and is prepared for its eventual retirement.

At the end of the 10 day period the avatar will reach the retirement age. When this happens the avatar will be moved to either the retirement home or the employment office. Going to the retirement home means your child was able to get enough to retire. Going to the employment office indicates your child did not save enough. It does not

really matter where your child's avatar winds up. What is important is your child has fun playing the game and learns something about finances.

Once the game ends your child will need to go back to the web site and complete a post test. This test asks the same questions as on the pre-test they took before they started playing. This is done so it can be seen if the game has taught them anything. I'll also ask your child to fill out a questionnaire. This questionnaire gathers basic computer knowledge and asks their opinions on the game, was it fun, easy to use and so on. The questionnaire will be given to your child by their instructor after your child's avatar has retired. The questionnaire is fairly long, so will take about 15-20 minutes to complete. Once your child has completed it, it should be returned to their instructor.

There are no risks to your child, the player. Any decisions they make will affect their avatar though. It is hoped that by playing the game and trying to make sure your child's avatar is comfortable, has a home, a job etc. that they learn some financial concepts that may benefit them when they become older.

Participation is voluntary your child will not receive any grade or reward for taking part in this research.. Your child can withdraw from the study at any time. If your child decides to withdraw you can contact me via email and let me know your wishes. Alternatively, if you have not returned the completed questionnaire to your teacher within 3 days after the end of the game I'll withdraw you from participation in the study. Any information gathered (pre-test results; post-test results; game character, etc) will be deleted.

Completion of questions in the pre-test and post test is required to measure learning. Answers to the pre-test and post-test will be stored on a computer in a database. When your child registers on the web site they will need to provide their name. When they take the pre-test and post-test the answers will be associated with that name. Your child and your child's teacher can view the answers using the game web site. I also have access to the data in the database. Answers will not be provided to anyone else.

Completion of any question on the questionnaire is voluntary. Feel free to omit any question you or your child are not comfortable answering. The questionnaire will be given to your child by their teacher. The questionnaire should be completed and returned to the teacher who will return them to me. The questionnaire will allow me to match your child's game experience with the results of the pre-test and post test. It is only used for this purpose.

All of the information collect will only be used for evaluating the game, how well your child does and what your child's opinions of the game are. The information will not be used for any other purpose. When the test is done your child's answers will be saved with the results. If I or another university student continues with this game they will have

access to your child's answers, but the information will only be used for future development of the game.

The existence of the research will be listed in an abstract posted online at the Athabasca University Library's Digital Thesis and Project Room; and the final research paper will be publicly available.

If you have any further questions or want clarification regarding this research or your participation, please contact:

Researcher:

David A Jones

david_alan_jones@hotmail.com

Research Supervisor:

Maiga Chang

maiga@ms2.hinet.net

This study has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns regarding your treatment as a participant in this study, please contact the Office of Research Ethics at 780-675-6718 or by e-mail to rebsec@athabascau.ca.

Please review this letter with your child so they are aware of the study and what is required for them to participate. If your child would like to participate in this research study, please have them read and sign the consent form on the next page. I will also need your permission to allow your child's participation. Please read and sign the parental consent form and return both by mail to me in the attached self-addressed envelope.

Sincerely

David A Jones

Graduate Student

APPENDIX D

Parental Participation Consent Forms.

This is the consent form parents will sign and return allowing their child to participate.

CONSENT (Parents):

I have read this Letter of Information and have had any questions answered to my satisfaction, and I will keep a copy of this letter for my records. My signature below is meant to confirm that:

- I understand the expectations and requirements of my child's participation in the research;
- I understand the provisions around confidentiality and anonymity;
- I understand that my child's participation is voluntary, and that they are free to withdraw at any time with no negative consequences;
- I am aware that I may contact someone in addition to the researcher if I have any questions, concerns or complaints about the research procedures.

Print Parents Name: _____ Date: _____

Parents Signature: _____

Children(s) Names _____

APPENDIX E

Questionnaire To Be Completed Before Playing.

Dear participant,

This questionnaire is being used to get your opinions on the game to teach finance. Please answer the following questions based on your game playing experience and your opinions of the game. There are quite a few questions, so it will likely take 15-20 minutes to complete. Your name is required so your experiences with the game can be matched to the results of the pre-test and post-test. The answers on the questionnaire will only be used for the research project, they will not be used for any other purpose. Completing this study will help in this project a great deal. Completion of this questionnaire is voluntary. We would appreciate it if you would complete it fully however feel free to not answer any questions you are not comfortable with. Once your avatar has retired, please complete the questionnaire as best you can and return it to your teacher. The teacher will be returning the questionnaires to me at the end of the test. Only the questionnaires returned will be included in the results.

If you have any comments or concerns, please contact:

David A Jones

david_alan_jones@hotmail.com

Maiga Chang

maiga@ms2.hinet.net

Section #1: Demographics and general computer usage. (I will not use section name in the official questionnaire)

1. Name: _____
2. Gender: Male Female
3. Have you ever played video games (console or hand held)? (e.g., PS2, PS3, Wii, Xbox, PSP, NDS, and so on.)
 Yes Never (if Never, please go to question #5)
4. How many hours per day do you play video games? (Please omit holidays and summer/winter vacations.)
Monday Tuesday Wednesday Thursday Friday Saturday Sunday
___hours ___hours ___hours ___hours ___hours ___hours ___hours
5. Have you ever played a computer game? (i.e., the games that can be played on computers.)
 Yes Never (if Never, please go to Part - II)
6. How many hours per day do you play computer games? (Please omit holidays and summer/winter vacations.)
Monday Tuesday Wednesday Thursday Friday Saturday Sunday
___hours ___hours ___hours ___hours ___hours ___hours ___hours

7. When did you start playing computer games?
 Before you started school Before grade 4 Grade 4 or after
8. Where do you usually play computer games?
 Home School Friends' place Other: _____
9. What kind of games are your favorites? (Please select the Game type and Game genres)
- | | | |
|--|--|--|
| <input type="checkbox"/> Standalone Game | <input type="checkbox"/> Multi-player with less interaction | <input type="checkbox"/> Multi-player with rich interactions |
| Description: The game you can play alone on your own computer without either internet connection or other PC's connection. | Description: The game you play with internet connection. In the game you see lots of players but you don't have to interact with them. | Description: The game you play with internet connection. In the game you see lots of players and you may team up, chat, fight, and interact with them. |
- Advergames. Adventure Arcade game Fighting
 First Person Shooters (FPS) First Person Sneaker
 MMORPG: 'Massively Multiplayer Online Role Playing Games'
 Platform (Ex: Super Mario Bros)
 Puzzle Racing Games RPG: 'Role Playing Games'
 Strategy Games RTS: 'Real Time Strategy'
 Serious Games (Serious games are games aimed at teaching, discussing or debating real-world concepts via game-play.)
 Simulations (EX: SimCity and Flight emulators)
 Sports Games TPS: 'Third Person Shooters'
 Other: _____

The following questions are used to understand your experiences with computers and video games. Please answer each question by selecting what you think on for each question. Your answer is a range from strongly agree to strongly disagree.

Strongly agree <-----> Strongly disagree

I like taking courses that use computers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like it when people talk about computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel comfortable while playing computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using computer games in school is a good way to learn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like listening to news of computers and information technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am very interested in solving quests/questions/missions in computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I always try to solve the current quest/question/mission in the computer game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I will try to find the solution to a problem by talking to a real person if I have a quest/question/mission which I cannot solve in the computer game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that computers are essential tools in the modern world.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would join a computer club if my school had one.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like taking in computer courses in school.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would attend summer/winter computer camps if my school had them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing computer games make me happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing computer games is part of my life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I have free time, I play computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I talk about computer games with my friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not alone in a computer game as I can make friends there.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am good at playing computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Playing computer games is easy for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I understand and play computer games well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am skilled computer game player.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can install and set up other required software for a specific computer game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I know how to get the instructions to install computer games.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think computers make a difference in the modern world.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would enjoy a school subject more if I could play a related educational game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing computer games improves my eye and hand coordination.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing computer games enhances my imagination.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Playing computer games improves my typing skills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to read relevant information about computers and technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX F

Questionnaire To Be Completed After Playing.

Dear participant,

This questionnaire is being used to get your opinions on the game to teach finance. Please answer the following questions based on your game playing experience and your opinions of the game. There are quite a few questions, so it will likely take up to 25 minutes to complete. Your name is required so your experiences with the game can be matched to the results of the pre-test and post-test. The answers on the questionnaire will only be used for the research project, they will not be used for any other purpose. Completing this study will help in this project a great deal. Completion of this questionnaire is voluntary. We would appreciate it if you would complete it fully however feel free to not answer any questions you are not comfortable with.

Once your avatar has retired, please complete the questionnaire as best you can and return it to your teacher. The teacher will be returning the questionnaires to me at the end of the test. Only the questionnaires returned will be included in the results.

Participation in this test is voluntary, and you may withdraw at any time. If you wish to withdraw from the test, please send an email to me at david_alan_jones@hotmail.com.

If you have any comments or concerns, please contact:

David A Jones
david_alan_jones@hotmail.com

Maiga Chang
maiga@ms2.hinet.net

Name: _____

These questions ask what you thought of the game.

Strongly agree <-----> Strongly disagree

Game Play:

- | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| The screens are easy to use. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| It is easy to learn how to play. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I want to explore the game's world. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| It is hard to find the functions that I am looking for. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| The game would be better if it had background music. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would have more fun if I could team up with other players in the game. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Contents of the game

- The freedom allowed makes the game more interesting.
- The events affecting my avatar give me some ideas of what I should do.
- The integration of events and financial actions is perfect.
- I am engaged by the events affecting my avatar and relevant financial actions to deal with those events.

Your opinions:

- I would play the game more if I could.
- I would like to introduce the game to other people.
- I would like to use other, similar systems.
- I would play the game if many of my friends are playing.
- I would like the game to be used in a school class to teach finances.
- I would like some direction in playing the game by having a teacher guide me.
- I hope that the game could have following additional functions in its future upgrade. (optional question)

Please assess and score the game, from high (5 points) to low (1 point).

- 5 <----->1
- The terms and functions in the game are easy to understand.
 - I have no difficulty in using it.
 - I can get needed information quickly within the game.
 - I can get familiar with the objects (i.e. devices, room places, items) quickly by playing the game.
 - This game provides me enough information for what I want to know.
 - This game provides me enough information for learning.
 - I can complete the learning activities that the game asks by traveling in the real world.
 - The information provided by the game is correct.
 - The information provided by the game can be trusted.