

PECUNIA - A LIFE SIMULATION GAME FOR FINANCE EDUCATION

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Research literature from around the world suggests that younger children can benefit from finance education as much as older ones if not more. Playing games is also equally attractive for children and young adults, so combining finance education with games can provide them with opportunities for learning about different financial decision through trial-and-error without putting themselves into risk situation. Pecunia - the game world - is developed with exactly this aim in mind. Pecunia in Latin means money. Pecunia utilizes the open-source platform OpenSim (similar to Second Life) where students take the role of an 18 years old male/female character and live his/her life in terms of making various financial decisions and see through the consequences. The game provides a sound underpinning of the skills needed to make good financial decisions, hence preparing students for being good citizens in later life. The financial rules can be changed so the game can be used worldwide for people in different countries.

Keywords: Multiplayer Online Role Playing Game; children; youth; educational game; game-based learning; finance education; money management.

1. Introduction

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 (Cooperberg, 2009). This education is needed due to the changing financial landscape all over the world. People generally know about the importance of balancing their chequing account and having savings account. Beside the chequing and savings accounts there are many other financial services, products and providers that people need to be familiar with today. If people do not have appropriate financial knowledge, they may make poor decisions for their life. On the other hand, if people get educated properly,

then they may make better financial decisions which will lead them to a better life in their own future (Greenspan, 2005).

Research literature suggests that finance education begins in childhood - the younger the better (Alt Powell, 2004; Calapp, 2002; McCormack, 2007; Pachner, 2008; Truong, 2010). Children are 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 (Personal Finance Education Group, 2009). A child will often follow in their parents' footsteps, making similar financial decisions. If the parents are not properly educated, the children will learn the same habits (Orman, 2010). Starting to teach children early instills the proper attitudes and behaviors which will allow them to be successful later in life. When these children become adults they are better able to handle money effectively and have better financial habits so they are more likely to be financially successful (Alt Powell, 2004; Truong, 2010).

The research team has designed and developed a game where children are in control of the financial future of their avatars. The game aims to teach them basic and advanced financial skills (Jones & Chang, 2011, 2012). Children can try different financial tactics and see the results without actually hurting their future but still having immersive experiences of the consequences caused by the decisions they have made. A pilot study has been conducted to solicit participants' feedback on the game. Sixteen participants ranging between 11 and 51 years of age from a school in central Canada took part in the pilot. Although the pilot study was limited in terms of the small number of participants from a Canadian school, the financial topics covered in the game are generic and universal, making the results of the study relevant to wider community and the research having wider implications at the international level.

The main research question of the study focused on whether the game results in an increase in knowledge of financial concepts. Other questions center on users' attitude toward computer games in general, technology acceptance and the game's usability. Two moderators have also been taken into account - gender and gaming experience. The questions analyzed in this research are as follows:

- Does playing the developed game result in an increase in the player's knowledge of financial concepts?
- Do the player's attitudes toward games in general influence his/her attitude to playing?
- Does the game's 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?

The next section discusses some important background of finance literacy and educational games. Section 3 briefly introduces the game design and the game rules. The pilot design and the data collection method are explained in sections 4 and 5. Section 6 analyzes the research results. Finally, section 7 first summarizes the research and then discusses the findings and the possible improvements to the game.

2. Research Background

2.1. Financial literacy

In recent years, the number of mortgage options and mutual funds available in the market has become too large for people to easily make adequately informed decisions. Savings and borrowing are also becoming too complicated for people not using financial calculators or spreadsheets. It is therefore becoming rather difficult for people to make financial decisions without assistance. Lusardi and Mitchell (2007) used a questionnaire to investigate how much people know about personal finance and economics. They found that the average mark that adults received was C, which indicated that people do not plan properly for retirement, borrow money at higher interest rates and do not have the ability to acquire assets (Cole & Niles, 2008; Lusardi & Mitchell, 2007). Saving for the future is very important for all of us; however, according to a study conducted in 2005, only 68.5% of high school students had a savings account (Lusardi, Mitchell, & Curto, 2009). This trend seems to be on-going, since another study almost 15 years ago in 1999 revealed that only 50% of students admitted that saving was important (American Savings Education Council, 1999).

Research also suggests that most people do not realize they are making poor decisions even they do so. Researchers in Germany conducted a study in 2003, which found that while 80% of the participants had confidence in the financial decisions they made, only 42% of the participants answered the financial questions correctly in a test (Lusardi & Mitchell, 2007). In a study done in 2004-2005, a series of questions was asked of 1,891 college students to determine their financial fitness. 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 calculated to analyze 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 (Cude et al., 2006). 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.

Financial literacy can be affected by exposure to financial institutions. In Japan, it is common that younger children lack knowledge of financial institutions since they are not exposed to them at an early age. In New Zealand, financial education is not required at all (Feslier, 2006). 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 (Holden, Kalish, Scheinholtz, Dietrich, & Bovak, 2009). In United States, only seven states require students to take a course on personal finance (Johnson & Sherraden, 2007). In Canada, 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 (Orton, 2007).

A study in 2000 by Toussaint-Comeau and Rhine (2002) on how to deliver financial programs to adults in the United States 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. What this report failed to indicate was that many of those taking the financial programs were already in trouble financially. These programs would be classified 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 (Lusardi et al., 2009).

High school is perhaps the last opportunity for society to mandate financial education. High School Financial Programming Program® (HSFPP) in United States 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 (Danes, Huddleston-Casas, & Boyce, 1999). Although this program has been offered in high schools for the last several years, two studies from 2009 questioned the effectiveness of such program and indicated that students were no more financially literate than those who did not take the finance course. They questioned the effectiveness of further high school financial education (Mandell, 2009; Mandell & Klein, 2009). The studies suggested that the ineffectiveness of financial literacy programs may be linked to motivation (Mandell & Klein, 2009). These high school students have poor attitudes and behaviors toward financial literacy and do not see its importance, so they are not motivated to learn it (Mandell & Klein, 2007).

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. 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 (Russell, Brooks, & Nair, 2006). 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 better recalled and understood the concepts more than students in grades 7 and 8. While all grades did show some improvement, this study seems to indicate that teaching children at a younger age is better (Mandell, 2006).

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 (Mandell, 2006). In addition, they have typically acquired the skills necessary to learn the material and have generally not started making large financial decisions, so it is early enough in their life that they can use the education to enhance their financial future. Students before this grade generally do not have the necessary prerequisite knowledge 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 already been done.

2.2. *Game and learning*

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 (Cribbage, 2013; War, 2013), matching (Go Fish, 2013; Rummy, 2013) and more complex mathematical skills (Contract Bridge, 2013; Cribbage, 2013).

More and more games have been designed for teaching and learning in the last decade (Fletcher & Tobias, 2006). Parker (2003) believed that educational games can make learning attractive. Students can learn in a friendly environment (i.e. game) if the game is designed for specific subject or skill (Gee, 2003; van Eck, 2007). Furthermore, several researchers have pointed out that educational games can help students learning complex contents (Garris & Ahlers, 2001; Ricci, Salas, & Cannon-Bowers, 1996). For example, Corbett et al. (2001) used educational video games to teach algebra cognition and Kahn (1999) designed a computer game to teach programming language.

Edubingo is a digital game designed to teach math (Cheng, Deng, Chang, & Chan, 2007). 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, he/she clicks 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.

Farmtasia is a digital game designed to simulate managing a farm (Cheung et al., 2008). 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.

The U.S. Military uses a massively multiplayer online role playing game (MMORPG) in order to teach its forces how to deal with improvised explosive devices (IEDs), a new and very common danger in today's world (O'Connor & Menaker, 2008). 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.

Research in the literature has suggested 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 solve problem 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 (Hsiao, 2007).

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. A 2009 study in the United States identified the game playing population age ranges to be from 10 to 34 with the majority of game players between 14 and 19 years of age (Zin & Yue, 2009). 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 (Eow, Ali, Mahmud, & Baki, 2009). 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 (Bourgonjon, Valcke, Soetaert, & Schellens, 2009).

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 (Kebritchi, Hirumi, & Bai, 2010). 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 (Papastergiou, 2009).

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 (Mandell, 2006). They are motivated to learn the material and seem to show the most improvement in knowledge among all groups tested. Combining this education with a game leverages the benefits of game play. Games are fun and motivational which encourages the students to continue playing. It allows the students to solve problem in a way that makes sense for them, and allows them to see the outcomes of their decisions. These decisions are done in a safe environment - if a poor decision is made, the only thing affected is the player's character. The students can learn from the mistakes 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.

3. The Game

There are many different game genres, including simulation, strategy, action, and role-play, and many of them allow the students to reflect and learn from their actions (Apperley, 2006; Hsiao, 2007). A digital game can 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 (Wilson et al., 2009). The result is that the player experiences a lack of control within a simulation. Since it is attempting to simulate the real world, the player is bounded by the real world environment (DiPietro, Ferdig, Boyer, & Black, 2007). A relationship between games and simulations is highlighted in Figure 1 (Tang, Hanneghan, & Rhalibi, 2009).

Games include a competitive activity set in an artificially constructed context. They have rules and constraints that must be followed to reach a certain goal. Simulations are similar; the difference is that they try to accurately represent the real world (Wilson et al., 2009). As can be seen from Figure 1, games and simulations can be combined together to form a simulation game. Such games provide a balance between both the entertainment and educational components. They are similar to a game in that they are developed in an artificially constructed world. At the same time, the simulation aspect tries to simulate the real financial situations the 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.

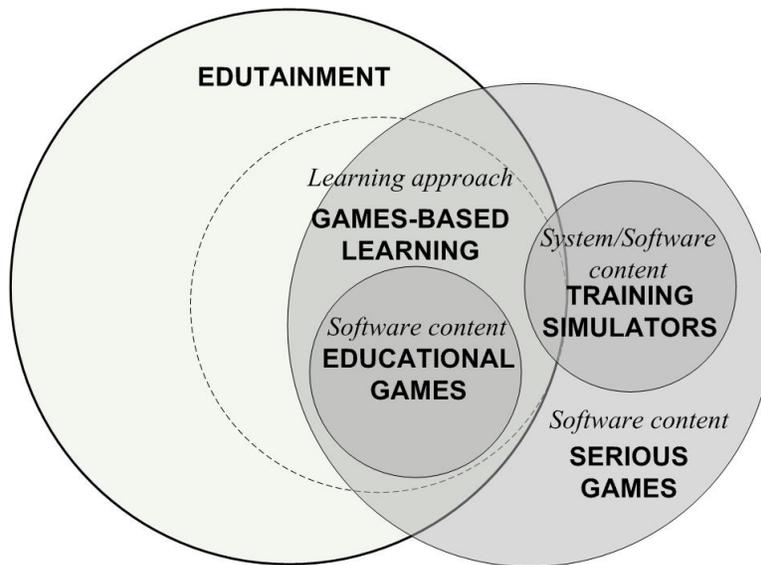


Figure 1. Game/Simulation relationship (Tang, Hanneghan, & Rhalibi, 2009).

The research team has designed and developed a fun to play (massively) multiplayer online role playing game (MMORPG) capable of teaching younger students how to better manage their personal finances (Jones & Chang, 2011). 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. The game stresses personal finances, but also shows how a poor decision can have a negative effect on others in the game as well as how a wise financial decision can make the game better for other players (Jones & Chang, 2012).

The HSFPP (Danes et al., 1999) lists particular topics necessary for proper financial education. These topics also appear in the Dollars with Sense program offered by Junior Achievement (Junior Achievement, 2013). Some of the items specified in these programs are used in the game, as listed below:

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

The possibilities for the types of financial transactions players 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 has a fairly tight scope. The financial transactions to be encountered are based

on what typical middle-class Canadian students might encounter in their life time. Those playing the game are considered to be average Canadian grade 6 students. The game does not currently adapt to the needs of disabled students. The game is 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 three 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 three 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 illness will be assigned (from 1 to 7). When sick, the players are confined to the hospital. If players allow their avatars to starve they become sick and are sent to the hospital for 9 days. If they overfeed the avatar and it becomes obese, the avatar is sent to the hospital for 8 days. No catastrophic illnesses occur in the current release.
- When players get 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 do not pay, they wind up in jail. While a player's character is in jail they cannot work, so they lose income. Number of days of confinement increases 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 current release, only not paying fines on time.

The financial transactions the players need to guide their avatars through are as follows:

- Buy items. These items can be paid for with cash, savings accounts or credit cards.
- Open an account at a bank. It might be a savings account, loan or mortgage.
- Open 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 the 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 avatar's home. Cheapest and easiest way to keep the avatar fed properly, but still costs.

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

- All players begin the game at age 18 with \$1,000.
- Every player requires some sort of job. This job will provide income needed to live (each player can only have a single job).
- Players can quit a job at any time. While unemployed they live off their personal savings until they get another job.
- Not having enough money to live on results in illness.
- Illness results in the inability to go to work, resulting in a loss of income. While ill, the player is confined to the hospital.
- 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).
- A player's extra funds can be handled in three ways: by the avatar carrying it around, hiding it, or placing it in a bank.

- Players do not need to make use of a bank. If they do not, then everything they purchase is by cash.
- Any player can be robbed or lose all the cash he/she is carrying.
- 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 is not implemented).
- Students need to borrow money to go to school (unless they have enough cash or savings). Government loans are not implemented, nor will students have the financial resources initially to go to school without financial help.
- The higher a player's education, the more a player can earn.
- If the players do 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 are posted. If the players are successful in getting the job, their job title and salary will increase.
- Players 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.
- Players can borrow money by getting a personal loan or mortgage from a bank. They must apply for it 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 is calculated by total income divided by total liabilities. Different institutions use different ratios ranging from 30-50%. In addition, a random factor is also considered that allows the financial institutions loan officer to grant or deny based on the institutions financial guidelines and their instincts. This is implemented by generating a random number to represent the officer's 'instinct'. This number is 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 his/her total debt service ratio.
- Credit cards are available from credit lending agencies. The players must also apply for them and they can be refused. Getting a credit card depends on how much the player is currently in debt (total debt service ratio). This is calculated by total income divided to total liabilities. Different institutions use different ratios. It is much easier to get a credit card as acceptable debt service ratios are higher, ranging from 40-60%. Players' avatars must have jobs and they cannot be in arrears on any payments. In addition, a random factor is also considered that allows the financial institutions loan officer to grant or deny based on the institutions financial guidelines and their instincts. This is implemented by generating a random number to represent the officer's 'instinct'. This number is used to determine if the loan is acceptable or not (bank credit cards and accounts are not implemented in the current release of the game).
- Personal loans, mortgages and credit cards are subject to interest charges.

- Personal loans are for larger items, such as cars and furniture. The item is used as collateral against the loan. If the player misses a few payments, then overdue interest is 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.
- 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 player's discretion.
- Credit cards are for any type of purchase. No collateral is needed. If a player misses a payment then overdue interest is charged. If too many payments are missed (3 payments) then the lending institution can repossess anything owned by that player to pay off the amount owed. Interest rates are high. There is a minimum payment required (3% or \$50 whichever is higher). A maximum credit limit is also in place (\$5000).
- 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 his/her house. Interest rates are typically low. Payments occur over a long time.
- A player should have a place to live (rent an apartment or buy a house). Living on the street raises the chance of becoming ill considerably.
- Not paying rent results in the player being evicted (after missing 3 months' rent).
- Players must pay utility bills every month for their dwellings (electricity, water, gas). Not paying bills (within 3 months) results in eviction from the dwelling.
- Players need to eat and drink, so they must purchase food and drinks on a regular basis. Not eating and drinking results in the players becoming ill, going to the hospital and missing work.
- Tax is paid on everything.
- If a player has purchased insurance and an item is stolen or broken, the item is replaced without question.
- Players' characters retire at age 65. Past this age the players lose control of the character (to play again they need to create another character).
- Players win 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).

A series of random events have been added to the game to help keep the players engaged. These events include: random sickness, random fines (and possible jail time), insurance claims, and losing cash. An avatar also has a health value. As days progress, this value drops. Players must ensure that the avatars eat enough to keep the value in balance. If they do not eat enough they will starve and wind up in the hospital. If they overeat they will become obese and wind up in the hospital. In either case they cannot work and will lose pay for the days in the hospital.

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's 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 as the avatar's adult lifetime. When starting the game, the player's avatar is 18 years old. The passing of 1226 weeks 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, which equate a single two week period of game time to approximately 35.23 minutes in the real world (720 real hours/1226 in-world two week periods). A single day is 1/14th of this time, approximately 2.51 minutes in the real world.

4. Pilot Study

4.1. Pilot design

A common approach is to test knowledge of the game subject matter before game exposure (pre-test), then test on the same subject matter after playing the game (post-test) (Danes et al., 1999; Wilson et al., 2009). Once both evaluations are done the results are compared. The advantages to using the pre-test and post-test approach is that it has already been used in a variety of situations, from testing learning in courses as well as learning experienced by playing games. Since pre-test and post-test evaluation method has already been used successfully in the literature to evaluate the effectiveness of education in courses and games, this is the method employed in this study.

Before playing, students completed the pre-test which asked questions from a test bank of 20 financial questions. Completing the pre-test was required as it actually generated the student's avatar in the game world. In addition to the pre-test, the students were also given the first part of a two-part questionnaire. The information collected in the first part of the questionnaire included demographics on the players as well as their experience with computer games in general. The questionnaire also collected information on basic computer experience and computer game attitudes using a modified Computer Game Attitude Scale (CGAS). This scale is used to measure the players' attitudes toward computer games. The scale was first introduced in 1997 and has proven to have strong validity and reliability in measuring attitudes (Chappell & Taylor, 1997; Chen, 2007; Chen, 2010; Liu, Lee, & Chen, 2013).

The students could then sign on to the game world using the game software and begin to play the game. When their avatars reached retirement age, they were moved to the retirement home if they had enough to retire. If they did not, they were moved to employment office. Once moved, the avatars could not be played any longer (they became restricted to that location and could not leave).

Upon completion of the game, the students needed to sign on to the web page and complete the post-test of financial questions. They were also asked to complete the second part of the questionnaire. This questionnaire obtained the following information:

- Perceptions and Attitudes toward 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 (Ibrahim, Khalil, & Jaafar, 2011).
- Usability information by using a modified altered System Usability questionnaire. Usability measures whether the system is easy to use, efficient to use, easy to remember, has few errors and is pleasing (in a subjective manner) (Lu, Chang, Kinshuk, Huang, & Chen, 2011).

Since the preferred target audience of the test was grade 6 students, several components of the questionnaire had been simplified. Some questions were removed altogether, while others had their wording changed. The intent was to reduce the question complexity down to an appropriate level for a grade 6 student. For those participants under 18 years old, their parents were required to complete a permission form. Once completed, the participants were able to register on the game website. They then completed the pre-test and part 1 of the questionnaire. The pre-test was composed of a series of true/false and multiple choice questions, that have been drafted using examples obtained from various financial institutions, financial education institutions and organizations, and questions developed by the researcher. After downloading and installing the game software, the participants could sign on and begin exploring the game world. They continued to play the game over a period of time, approximately 30 minutes per day. At the end of the pilot, the players were asked to complete the post-test and second part of the questionnaire. Taking the post-test allowed for the measurement of the amount of learning for a student.

4.2. *The questionnaire*

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 toward computers and computer games in general.

For the experiment, the CGAS 2011 questionnaire revised by Lu was used (Lu, 2012). Modifications were needed for the questionnaire before 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 make them simpler so that they could be understood by the intended audience (grade 6).

The final questionnaire used in the study had 29, five point Likert-scale items (5 for “Strongly Agree” to 1 for “Strongly disagree”). These 29 items were categorized into five factors as listed below:

- (1) Attitude toward computers;
- (2) Attitude toward computer games;
- (3) Comfortable (with playing computer games);
- (4) Liking (computer games); and,
- (5) Confidence (of playing computer games)

Part 2 of the questionnaire was also based on the questionnaire used by Lu in 2012. The original questionnaire contained many questions specific to Lu’s own research project. As a result, fourteen of the items were removed. This questionnaire also used the five point Likert-scale items (5 for “strongly agree” to 1 for “strongly disagree”). The questionnaire addressed the four main constructs of the Technology Acceptance Model (perceived ease of use, perceived usefulness, attitudes toward use, and behavioral intention of use) as well as the three constructs of usability (system effectiveness, system efficiency, and the user satisfaction).

4.3. *The pilot*

The experiment began on January 12, 2013. 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 registered and completed the pre-test and the first part of the questionnaire, these results have been removed from consideration. The final number of participants included in the analysis of this research is therefore 16.

Participants ranged from 11 to 51 years of age, eleven of which were males and five 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 participants’ homes on their own personal computers, using software downloaded by the participants to play the game.

To register the participants, researchers visited their home in the early evening or on a weekend. Before visiting, they spoke to the participant’s parents (if the participant was a child or youth) to ensure they approved of their child participating in the study. Parents were also informed 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 parents 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 of 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, the parents and the child were provided with a written explanation of the process. The parents were then

asked to sign the consent form. Once signed (if the participant was a child or youth), the participant was asked to complete the first part of the questionnaire and the actual registration of the player was started.

During the registration process, the participants were encouraged to complete the process themselves. They first had to navigate to the game website, register and validate their account. After the registration process was completed, the participants signed in to the website. They were briefly explained the options available to them and were asked to complete the pre-test. Once this test was completed, their avatar was created in the game world. They were advised that at the end of the pilot they would need to return to the website to complete the post-test.

The participants then downloaded and installed the game software. Once installed, the participants started the game software and signed on using their account. This served two purposes. By having the participants sign in immediately, their avatar began aging and experiencing life events. This started the game for the participants, requiring them to start monitoring the avatar. It also allowed the researchers an opportunity to demo the software and show the most used functionality for conducting the basic tasks in the game. The demonstration also included some of the most often used interface items.

In a few instances, the participants were unable or unwilling to start playing the game on the evening they registered. In those cases, researchers conducted the demo using a test account.

Once the participants completed playing the game (at the end of the pilot), they completed the post-test by returning to the website, and completed the second part of the questionnaire which was left with the participant's parents (for those who were under 18) when they initially registered. These questionnaires were either returned to the researchers by the parents or arrangements were made to return to the participant's home and pick them up. When getting the questionnaires back, the researchers 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 for gathering some of that information. Some of these facts will be discussed later on.

5. Data Collection

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, Lu (2012) discovered that the 'behavior' factor could not be reliably used. As a result, this factor is not considered in this research (even though the 'behavior' questions remain on the questionnaire). All the remaining factors are investigated.

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 visiting computer expo and question 16 which dealt with playing computer games after an exam. Question 13 belonged to the liking factor and question 16 belonged to the comfortable factor. Since these two factors have only been

Table 1. Validity analysis of CGAS questionnaire.

	Components		
	1 (ACG)	2 (COM)	3 (CFD)
Attitude Toward Computer Games-Q22	.796	-.256	.462
Attitude Toward Computer Games-Q28	.733	.088	.194
Attitude Toward Computer Games-Q29	.737	-.057	-.134
Comfort-Q2	.008	.543	.600
Comfort-Q3	-.235	.671	.549
Comfort-Q4	-.256	.721	.082
Comfort-Q15	.275	.904	.045
Confidence-Q18	.272	.214	.880
Confidence-Q19	.037	.056	.973
Confidence-Q20	-.049	.096	.930
Confidence-Q21	.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

reduced by a single question, it should have minimal effect on the reliability of the questionnaire. Table 1 shows the items included in 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 0.8533 (Wessa, 2010). This alpha factor value resides in the 'good' range, meaning the questionnaire in its entirety is reliable. Next each individual component in the questionnaire was measured. Two of the factors, 'Attitude toward computers' and 'liking' contained low alpha values. Any factor that has an alpha score below 0.7 is considered to have questionable reliability, so these factors were removed from further analysis.

With the reliability of the factors determined, the items validity in the factors was checked. As can be seen from Table 1, all items with the exception of one in 'Comfort' (item Comfort-Q2) 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.

At the end, ten items in three factors - three in 'Attitude toward computer games' factor, three in 'Comfortable' factor, and four in 'Confidence' factor - of CGAS were kept for further investigation.

The second part of the questionnaire which was completed after the participants played the game contained a modified Technology Acceptance Model (TAM) and a usability section. The TAM questionnaire was modified significantly from the one used by Lu (2012). Lu had added a number of factors in the questionnaire specific to that

research project. The factor 'Context awareness', which was comprised of six questions, and 'Voluntariness of Use' which contained five 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 toward 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 was determined, the entire TAM questionnaire received an alpha of 0.818, which resides in the good range and indicated that the questionnaire as a whole was reliable. Next, a check of each of the factors used in the questionnaire was completed. The 'Attitude to Game' factor had a very low alpha value. Since this factor could not be increased to an acceptable level, it was 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.

Next the validity of each of the remaining factors was determined using Principal Components Analysis. The results showed that three of the factors had issues that needed to be addressed. On the 'Perceived Ease of Usefulness (PEoU)', question 18 did not contribute to any factor with a value above 0.6. In 'Perceived Usefulness (PU)', three of the four questions did not contribute to the factor (or to any other factor, for that matter). In the 'Intention (INT)' factor, two of the questions did not contribute. One contributed a small amount (0.451), while the other only contributed 0.085. In an attempt to have the items contribute to the pre-defined factor better, questions 16, 18 and 20 were removed. Questions 18 and 20 were removed as they did not contribute to any factor with a high enough factor loading value. Question 16 was removed as it offered minimal loading to the component.

One item in 'Intention (INT)', question 12, did 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. In the 'Perceived Ease of Use' factor, question 2 seemed to fit better in 'Perceived Usefulness' and question 3 of 'Perceived Usefulness' seemed to fit better in 'Intention'. After careful review of each of the items, it was decided that these changes made sense, so the factors were realigned.

This required a recalculation of Cronbach's alpha to ensure all factors were still reliable. In this recalculation, the overall alpha value obtained was 0.8040 which is in the good range, meaning the questionnaire is still reliable in its entirety. Individual components scores are listed in Table 2.

The second part of questionnaire completed by the students also had a section dealing with usability. This section was designed to gather information on the participants' views on how effective and efficient the game was and how satisfied they were with it. The first action was to check the reliability of the questionnaire. In its entirety, the questionnaire

Table 2. Validity analysis of TAM questionnaire.

	Components			
	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

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

scored 0.8438 on Cronbach's alpha, hence lending in the good range, so it was considered reliable.

The 'Effectiveness' factor had a low alpha value, and it could not be increased by removing a question. This factor was therefore not used in this research. An examination of the remaining factors for validity found that question 24 did 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. The Cronbach's alpha for this section was then recalculated. The overall score for the questionnaire was now 0.8201, still in the good range. The final validity of the Usability questionnaire is shown in Table 3. While the 'Satisfaction' factor comprised of only two questions, the values of the two questions were high enough, so this factor was used in further analysis.

Table 3. Validity analysis of Usability questionnaire.

	Components	
	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

6. Results

6.1. Descriptive statistics

The first part of the questionnaire given to the students captured some demographic information and experience playing computer and video games. Table 4 shows a summary of this information.

As can be seen in Table 4, all participants had played video games of some sorts previously. The vast majority of participants had played video games as well. Table 5 summarizes the hours per week spent playing video games. It should be noted that 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 Table 5 are obtained from the test values for 'equal variances not assumed'.

From Table 5, it is easy to see that there are 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% were considered as 'power gamers' (eight participants with average 24 hours per week spent on playing games) while the remaining 50% were considered as 'regular gamers' (eight

Table 4. Demographic information.

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

Table 5. Male participants spent more time playing games.

	Gender	N	Mean (hours per week)	Standard Deviation	T value
Video Games only	Male	11	11.318	6.141	-4.808***
	Female	5	1.800	1.565	
Computer games only	Male	11	9.500	6.888	-4.134**
	Female	5	0.8000	0.758	
Total gaming per week	Male	11	20.818	9.785	-4.017**
	Female	5	2.600	7.917	

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

participants with average 6.25 hours per week spent on playing games). Unfortunately, no females made it into the ‘power gamers’ category due to the limited computer playing that they did.

6.2. Quantitative data analysis

A series of independent t-tests were then conducted on gender and gaming experience and the effect on Game Acceptance, Technology Acceptance and Usability. These tests have been designed to see if there are any statistically significant differences in perceptions between male and female players and between regular and power gamers. Several hypotheses are verified to find the answers of the research questions:

- H1-Playing the game has a positive effect on the player’s knowledge of financial matters.
- H2a-There is gender difference on the user’s computer game attitude scale.
- H2b-Attitudes about games have a positive effect on Behavioral Intentions to use the game.
- H2c-Being comfortable has a positive effect on Behavioral Intentions to use the game.
- H2d-Confidence has a positive effect on Behavioral Intentions to use the game.
- H3a-There is gender difference on the user’s perception of game usability.
- H3b-Perceived usefulness has a positive effect on the player’s behavioral intentions to use the game.
- H3c-Freedom in the game has a positive effect on the behavioral intentions to use the game.
- H3d-Perceived ease of use has a positive effect in the player’s behavioral intentions to use the game.
- H4a-Perceived ease of use has a positive effect on perceived usefulness.
- H4b-Perceived efficiency of the system has a positive effect on perceived usefulness.
- H4c-Freedom has a positive effect on perceived usefulness.
- H4d-Perceived satisfaction of the system has a positive effect on perceived usefulness.
- H5-There is a gender difference on the user’s technology acceptance of the game.
- H6-Gaming experience has an effect on the user’s technology acceptance of the game.
- H7-There is gaming experience difference on the perception of game usability.

Table 6. Descriptive statistics of pre-test and post-test results.

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

Table 7. Difference in the scores for participants on the pre-test and post-test.

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

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

The hypothesis of primary interest was the result of playing the game, namely, did participants learn anything from playing. Learning was measured using a repeated measures design. The repeated measures were pre-test and post-test taken by the 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 participants. Table 6 lists the descriptive statistics for the results of the tests. The mean of the post-test was almost 11% higher than the pre-test. While this did seem like a significant increase, a paired samples test was done to measure the exact effect. As indicated in Table 7, a significant difference was found in the scores for the participants on the pre-test and post-test. This indicated that the game succeeded in its purpose of increasing the knowledge of participants in financial matters. As a result, Hypothesis 1 was confirmed.

For testing hypothesis H2a, three factors were available for analysis, Attitude toward Computer Games, Comfortable, and Confidence. The group to be tested was Males vs. Females. As can be seen in Table 8, none of the factors show statistically significant differences, hence it cannot be stated that there is a difference between males and females

Table 8. Gender differences on factors of CGAS.

	Gender	N	Mean	Standard Deviation	T value
Attitude Toward Computer Games	Female	5	3.6667	0.4714	-0.0580
	Male	11	3.6970	1.1001	
Comfortable	Female	5	3.3000	0.9906	-1.5710
	Male	11	4.0000	0.7500	
Confidence+	Female	5	3.7449	0.4619	-0.0550
	Male	11	3.7565	0.1390	

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

+: Levene's Test for Equality of Variances failed

Table 9. Gender differences on factors of TAM.

	Gender	N	Mean	Standard Deviation	T value
Perceived of Use	Female	5	3.6000	0.8628	0.4840
	Male	11	3.3939	0.7574	
Perceived Usefulness	Female	5	3.6667	1.1304	0.7680
	Male	11	3.2424	0.9785	
Freedom in Game	Female	5	3.9500	0.9585	1.0350
	Male	11	3.4318	0.9158	
Intention	Female	5	3.0000	1.1319	-2.2680*
	Male	11	3.9773	0.6170	

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

in their attitudes toward computer games. As a result, Hypothesis H2a was not supported.

The same two factors (i.e. gender and gaming experience) were also used to test the effect on technology acceptance. First it was explored how gender might affect this model. In Table 9, one factor shows a significant difference. Between males and females, there seems to be a significant difference in Intention Toward the Game. Although it is only a single factor, it is significant, so Hypothesis H5 was conditionally confirmed. It is also desirable to know if there was a difference toward technology acceptance based on the players gaming experience. With similar analysis method, it was found that Hypothesis H6 was not supported.

Finally, gender and gaming experience were compared to the usability factors to see if any differences existed. The first comparison was using gender. According to Table 10, no statistically different values were found with regard to gender in terms of usability. As a result, Hypothesis H3a was not supported. Also, no significant differences were found amongst regular and power players. Hence, H7 was not supported.

In an attempt to determine how factors related 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 are shown in Table 11. Factors tested to see if they affected Intent to use the game include those from the

Table 10. Gender differences on the Usability factors.

	Gender	N	Mean	Standard Deviation	T value
Efficiency	Female	5	3.7200	1.0826	0.9730
	Male	11	3.2909	0.6833	
Satisfaction	Female	5	4.6000	0.5477	0.9520
	Male	11	4.2273	0.7863	

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

Table 11. Effect of CGAS and TAM factors on Intention to Play the Game.

	Unstandardized Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
CGAS							
Attitude toward Computer Games	-0.043	0.259	-0.044	-0.166	0.871	1.000	1.000
Comfortable	0.398	0.258	0.382	1.547	0.144	1.000	1.000
Confidence	-1.269	0.848	-0.372	-1.497	0.156	1.000	1.000
TAM							
Perceived Ease of Use	-0.011	0.314	-0.009	-0.034	0.974	1.000	1.000
Perceived Usefulness	0.112	0.237	0.126	0.474	0.643	1.000	1.000
Freedom in the Game	0.129	0.257	0.133	0.504	0.622	1.000	1.000

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

Dependent Variable: Intention

Computer Game Attitude Scale and the Technology Acceptance Model.

As can be seen from Table 11, none of the factors have a significant enough effect on Intention to Play the Game. As a result, the following Hypotheses were not supported: H2b, H2c, H2d, H3b, H3c, H3d.

In Table 12, factors that affect Perceived Usefulness are listed. 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 that 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 H4a was confirmed. Another strong factor that positively

Table 12. Effects of TAM and Usability factors on Perceived Usefulness.

	Unstandardized Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
TAM							
Perceived Ease of Use	0.693	0.298	0.527	2.231	0.036*	1.000	1.000
Freedom in the Game	0.457	0.263	0.421	1.738	0.104	1.000	1.000
Usability							
Satisfaction	0.534	0.344	0.389	1.582	0.136	1.000	1.000
Efficiency	1.126	0.137	0.910	8.202	0.000*	1.000	1.000

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

Dependent Variable: Perceived Usefulness

affected 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 H4b was confirmed.

The remaining two factors did 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 H4c was not supported. The remaining factor, namely satisfaction, also does not seem to have a statistically significant effect on Perceived Usability. As a result, Hypothesis H4d was not supported.

After playing the game, several comments were received from the participants. These comments offered suggestions from the user's perspective on how to make the game better. These comments include the following items:

- Several comments focused around the length of the pilot. Some of the participants were only just starting to understand how the game worked when the pilot already finished. 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 better.
- Some indicated that 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 have been 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.

7. Conclusion

The Pecunia game is a massively multiplayer online role playing game (MMORPG) designed to teach children financial concepts they will need as adults. Children 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 objective of the game is for the avatar to reach retirement age (65 years old) with enough money and belongings that the avatar can retire.

Children start the game as an 18 year old with the clothes on their backs and \$1,000 in cash. During their avatars' 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 children'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 the players. The game does not enforce a strict set of 'missions' or 'levels' of play. Children are encouraged to explore the game at their own speed.

The game 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.

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 were involved in many extra-curricular activities. As a result, the maximum number of students registered and actively playing the game at the same time was about 10. This had a negative effect on the 'multiplayer' component of the game since players rarely saw others playing at the same time they did.

The research findings determined that the game was successful at teaching participants financial concepts. The participants involved in the small pilot included children and adolescents, as well as adults. Although the involvement of different age groups in the pilot made it difficult for some hypotheses to be verified, the composition of the group showed potential of the game to be used by different age groups. The game aimed to teach players fundamental financial concepts which most of people thought they were already aware of, but in fact, they were not as many previous researchers found (Cole & Niles, 2008; Lusardi & Mitchell, 2007; Lusardi et al., 2009). Combining the fact that the game is applicable to not only children but also adolescents and adults, and many people do not really understand the importance of financial literacy, the proposed game can help people from different communities, including those who are students, who have just graduated from high schools, who are currently unemployed, and who are planning for their children and their own retired life. Furthermore, the game rules can be altered and the game can be available for people from different countries to sharpen their financial literacy.

At last but not the least, the game can be used as a life simulation platform not only for financial literacy, but also for ethics, career planning, life planning, law, mathematics and physics. The rules of abovementioned subjects can be designed and embedded into the game world and can be triggered when the players interact with the world and the non-player characters. The world and non-player characters will react differently according to player's background and behavior in the game. For instance, the hiring committee of a company in the game may or may not choose the player as he or she does not have enough learning and/or work experience in required background. Under such circumstances, the player may need to have better idea of what he or she need to do now for his or her dream career.

While some hypotheses were proven, many others were rejected. The reason for rejection might have been the relatively low number of participants (sixteen in total), and the composition of the group (adults and children). While the majority of children and

youth in the experiment had positive attitudes toward 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. In addition, it was realized during analysis that the female game playing component was considerably lower than was hoped.

The intention is for the game to be used in grade 6 classrooms by the teachers. It is hoped that the game could be used as a learning tool by the teachers to stress the importance of financial topics to the children. However, for the pilot study, this was not the case. Students enrolled themselves in the game and played on their own without direction. It became clear from the comments of the participants that 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.

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

- 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.
- In subsequent game releases, more research may need to be done into what financial items are considered more important than others. In the current 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.
- 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.
- The game's financial world exhibits stable situation, and lacks inflation and recession factors. Introducing these factors would help students better understand how their financial decisions are affected by forces outside of their control.
- The pre-test and post-test used to measure learning were based on North American financial standards. These standards may not apply in other regions of the world. Giving the teachers opportunity to revise these tests for their classes may improve their students' learning experience while widening the applicability of the approach to other locations.
- 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.
- There is no concept of charity in the game. Player avatars work only toward their own retirement, without concern for others in the game. Adding in a social component

may make the game more challenging, as the players will need to work to have their avatar retire while trying to make the virtual world a safer place to live. This could be accomplished by offering opportunities for the players to participate in social activities, contribute to charities, etc.

- The game dictates what successful retirement is. There is no way for the students to specify what they believe as a successful retirement. Allowing the students to choose or set parameters to be met may make the game more enjoyable.
- 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.

While the pilot study did show that the game is useful in achieving the objectives that were set out, a number of challenges were encountered. The biggest was being able to prove the primary hypothesis that the game helps educate players on financial matters. Being able to prove this indicates that the game is viable. There were also a few concerns on the playability of the game before the testing began. One of the concern was 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. Another test with a larger number of participants and with a longer test period may help generate more reliable results for all suggested hypotheses.

Findings suggest that the game may also 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 that they enjoyed playing the game and said it helped them understand basic financial matters better. Looking at individual test scores of the participants, 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 that the game is successful in educating financial matters.

The game did not seem to be as successful with the adult group. Of the group, about 37% were adults. Since this number is somewhat low, it is difficult to make any firm observations, but general trends could be mentioned. Most adults found the game to be difficult to play at times. This may be due to the lack of patience on the part of the adults as items complained about by the adult group were not mentioned by the children. In some cases, children in fact considered these parts of the game to be OK.

Analysis of 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. This seems to be due to the fact that the adults already had much better understanding of basic finances.

An interesting avenue of study would be to have a large group of participants in a variety of age ranges from various parts of the world play the game for the intended duration (30 days). At the end of the test, the data should be analyzed based on age and grade and note any differences. This analysis would also be beneficial in identifying

whether 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.

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