

**“I <3 MONEY”, TEACHING BUDGETING BASICS THROUGH GAME-BASED
LEARNING**

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the requirements for the degree of Bachelor of Computer Science with Honours
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DECLARATION

I hereby declare that this project is of my own work. I have not copied other students' works or from any other sources unless reference and acknowledgement has been explicitly provided. I also declare that no parts of this project have been written by another person.



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ABSTRACT

Budgeting is an essential skill in money management, and ignoring its importance leads to unwise financial decisions. As young adults are increasingly reported to lack financial security, it is important to educate this age demographic on budgeting and its importance. This project aims to assess the effectiveness of teaching budgeting to young adults through game-based learning. The methodology used for this project is the Outcome-based methodology for developing a game-based learning environment. To determine the learning outcomes that will be included in the game, a review of the EBU1063's course content outlines was done along with a survey distributed to young adults to understand their difficulties in money management. The results of the survey also serve to guide the game design and genre. Based on the results, four learning objectives are to be included in the game and the game developed will be a strategy adventure role-playing game.

ABSTRAK

Belanjawan ialah kemahiran penting dalam pengurusan kewangan, dan mengabaikan kepentingannya boleh membawa kepada keputusan kewangan yang tidak bijak. Memandangkan golongan dewasa muda semakin dilaporkan tidak mempunyai kestabilan kewangan, adalah penting untuk mendidik kumpulan umur ini tentang belanjawan dan kepentingannya. Projek ini bertujuan untuk menilai keberkesanan pengajaran belanjawan kepada golongan dewasa muda melalui pembelajaran berasaskan permainan. Kaedah yang digunakan dalam projek ini ialah kaedah berasaskan hasil (Outcome-based methodology) untuk membangunkan persekitaran pembelajaran berasaskan permainan. Bagi menentukan hasil pembelajaran yang akan dimasukkan ke dalam permainan, satu kajian terhadap garis besar kandungan kursus EBU1063 telah dijalankan, bersama dengan satu tinjauan yang diedarkan kepada golongan dewasa muda bagi memahami kesukaran mereka dalam pengurusan kewangan. Hasil tinjauan ini juga digunakan sebagai panduan dalam reka bentuk dan genre permainan. Berdasarkan hasil yang diperoleh, empat objektif pembelajaran akan dimasukkan dalam permainan, dan permainan yang dibangunkan akan berbentuk permainan strategi pengembaraan berperanan (strategy adventure role-playing game).

CHAPTER 1: INTRODUCTION

1.1 Background

According to Oxford Advanced Learner's Dictionary (2010), budget is defined as the money that is available to a person or organization and a plan of how it will be spent over a period of time. In general, budgeting involves tracking income and expenses to ensure the amount spent aligns with priorities and financial objectives. It is an important part of financial planning as it helps individuals identify areas that they might overspend on, allowing them to figure out which category of expenses should they cut back on.

Although many people are aware of the benefits of budgeting, not everyone practices it. Budgeting is a crucial part of financial planning, and therefore ignoring the importance of the act will result in poor financial management and ultimately bankruptcy. According to the 2023 report from the Malaysian Department of Insolvency, 4810 bankruptcy cases were filed in that same year. The report also states that from the total 37,461 bankruptcy cases that were administered from 2019 to 2023, 6996 of those who declared bankruptcy are below the age of 34, 122 of them being young adults below aged 25 and below (Malaysian Department of Insolvency, 2023). The fact that this age demographic makes up a significant portion of bankruptcy cases is very concerning and needs to be addressed properly.

Furthermore, according to a report by Prudential Malaysia in 2024 on financial security, it is reported that young people are finding it increasingly difficult to save money (Economist Impact, 2023). Although this finding is attributed to the skill set possessed by individuals not matching the skills required by the job market and wage stagnation during these recent years, it is also connected to the lack of financial knowledge among young adults. Choong et al. (2023) stated that those with higher financial literacy are better at managing their expenses through following effective budgeting techniques. With the right attitude and mentality, the probability of being more mindful when spending will also increase. Therefore, it is important to teach young adults how to develop this mindset as well as conveying sensible budgeting techniques that will help them in the long run. Having this knowledge at a young age will also ensure that they are able to prevent themselves from struggling financially and are able to develop a proper financial plan to exit those situations when inevitable.

There are many resources available on budgeting and financial literacy, however not many are engaging or relatable and are seen as daunting. This generally discourages young adults from interacting with the resources. Therefore, to combat this, a more interesting and interactive option is to impart this knowledge through a game. Game-based learning is an

approach where learning is done through games or related elements, concepts, mechanics or designs (Deterding et al. 2011). By implementing game-based learning to convey budgeting knowledge, it is possible to educate the importance and benefits of budgeting. In addition to that, by applying narrative in game-based learning, it will allow the player to artificially experience the causes and consequences of budgeting and financial planning through immersing themselves in the game and its narrative.

1.2 Problem Statement

Young adults often face a challenging transition from relying on their parents' consent for purchases to experiencing financial freedom, which can make managing finances difficult (Choong et al., 2023). With little prior experience in handling money, they tend to spend money in a way that is not sustainable for them. In addition to that, the spending habits of Malaysian young adults in university tend to be influenced by their peers, in the sense that they do not refer to their own budget when evaluating their spending, rather comparing their expenditure to how much their peers spend (Sundra Kumar et al., 2022). As they navigate this new landscape without proper financial knowledge equipped, the risks of overspending and accruing debt increase significantly. Therefore, it is crucial to educate these young adults on how to effectively manage their finances, equipping them with essential skills such as budgeting and saving. By fostering financial literacy early on, we can empower young adults to make informed choices and build a secure financial future.

1.3 Aim and Objectives

This project aims to propose a web-based game as a form of budgeting education for young adults. The objectives for this project are outlined below:

- a. To design a narrative game-based learning role-playing game about budgeting
- b. To develop a game-based solution to educate young adults on budgeting basics
- c. To evaluate the effectiveness of using game-based learning to teach budgeting to young adults

1.4 Scope

The target audience for the game is young adults aged 18 to 25 who are new to handling their own money. The topic covered in this project will be budgeting. The data analysed will be the player's knowledge of the topics covered before and after playing the game. The game itself will be a web-based role-playing game.

1.5 Brief Methodology

The project will utilize the outcome-based methodology proposed by Sison et al. (2018).

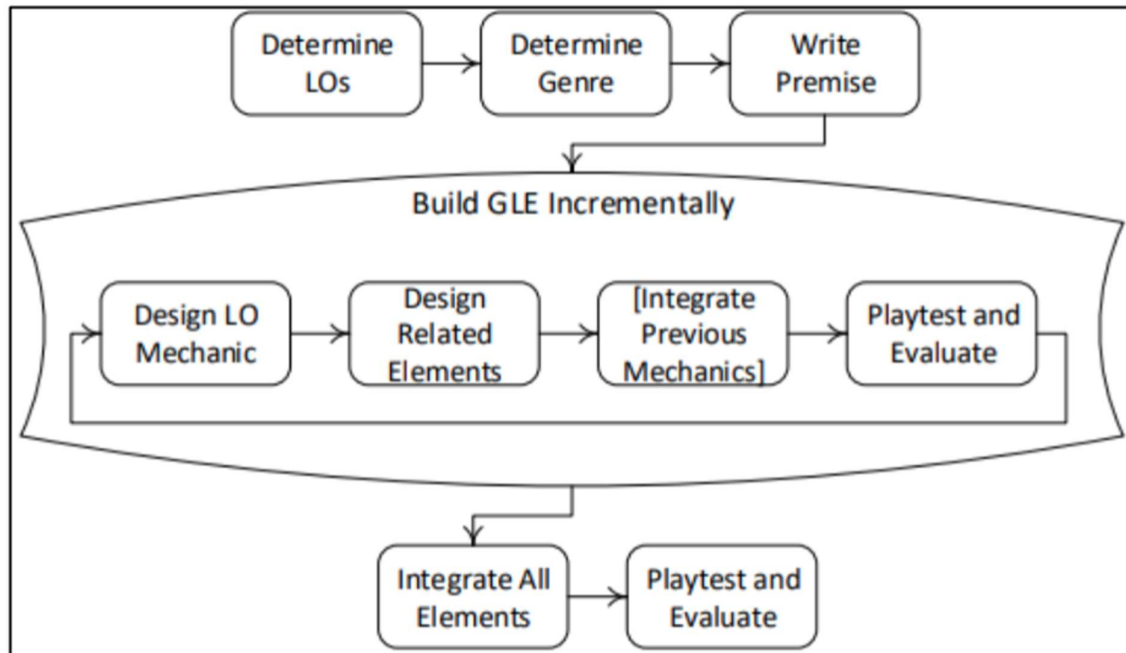


Figure 1.1 Outcome-based Methodology (Sison et al. 2018)

Based on Figure 1.1, this methodology has nine steps, with four steps executed iteratively. These four steps will lead to a new learning outcome (LO) mechanic with each cycle.

The initial phase of the methodology involves determining the LOs that will be implemented in the game. This will be done by reviewing the learning materials used in the elective course EBU1063 Smart Money Management, as well as conducting a survey to learn the financial topics that young adults struggle with. This will be done to ensure that the LOs come from proper sources and are useful to the players. These LOs will then proceed to drive the design of the game as well as its narrative.

The next step is to identify the game's genre. The genre is chosen depending on how appealing it can be to the target audience as well as being simple and straightforward for those who are unfamiliar to the genre. In addition to the previous statement, the genre is also determined by the game designer's knowledge of the genre and how it can be aligned with the chosen LOs.

Next is writing the premise of the game. In this stage, the main objective for the player will be determined as well as the strategies to achieve the said objective, and what is included in the game world will be established.

The fourth step is to design the LO mechanic. The LO mechanic serves to guide the player in achieving a LO as well as determines whether the LO has been achieved and to what extent. Next is to design the related elements to the LO mechanic. This would entail designing the scenario as well as the mini game involved. The sixth step is implementing the LO mechanic as well as integrating previous mechanics. The seventh and last step in this cycle is to playtest and evaluate the effectiveness. The fourth to seven steps are done iteratively, with each cycle making up an LO mechanic. In this project's case, it will comprise of different game mechanics and events that will simulate the experience of budgeting as well as a narrative that will influence the player's actions and choices.

Once all iterations of the cycle are done, the eighth step can be done, which is to incorporate the other aspects of the game that do not correlate with the LOs present or are not important. Lastly, the game can be play tested and its game-based learning environment can be evaluated as a whole.

1.6 Significance of Project

Upon the completion of this project, it will be revealed whether budgeting is suitable to be taught using game-based learning approach. This project goes beyond traditional educational methods by allowing players to experience the consequences of financial choices in a simulated environment. This practical experience can help users internalize the importance of budgeting and make more informed financial decisions in real life. The game's use of narrative will also enhance the user engagement and help the user to immerse themselves with financial planning, making the learning experience more impactful. Therefore, the outcome of this project can serve as an example of a teaching method for budgeting catered to young adults.

1.7 Project Schedule

This project is expected to be completed within a year, with its components split into two, being FYP 1 and FYP 2. FYP 1 is to be completed within the first semester (7th October 2024 to 2nd February 2025) and FYP 2 is planned to be done within the second semester (17th March 2025 to 6th July 2025). The Gantt charts for FYP 1 and FYP 2 will be in Appendix A and Appendix B, respectively.

1.8 Expected Outcome

The project is expected to produce a game that shares knowledge of basic budgeting to the players as well as an analysis of the players knowledge of budgeting before and after playing the game.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Financial literacy is a crucial skill to have in this age. People who lack financial literacy will create more financial mistakes, which will result in losing more money (Tyson, 2023). The need for financial literacy among youth is a sentiment that has been acknowledged by the Malaysian government. In July 2019, the Financial Education Network (FEN) released Malaysia National Strategy for Financial Literacy, put into action since the year 2019 to 2023. The paper states that the financial literacy and financial attitude of Malaysians should be improved, highlighting issues such as 1 in 3 Malaysians claim to have low financial knowledge, 1 in 5 Malaysian working adults not saving their money for the duration of 6 months, and more than half of Malaysians are not confident in their savings for retirement amongst other concerns (Financial Education Network, 2019). These issues are very concerning, and action must be taken to increase the level of financial literacy. The paper notes that one of the priorities is to nurture financial values from youth, injecting the pre-school, primary and secondary school curriculum with financial topics (Financial Education Network, 2019). However, those who have graduated the few years before this plan was carried out, today's young adults, are left behind in this plan. Therefore, it is important to include young adults in effort to increase financial literacy of Malaysians.

One way of imparting financial knowledge to young adults are through games. Interest for gamification and the development of games for educational purposes has been steadily growing for the past few years, with numerous studies being published each year on the topic. Games, whether physical or digital, have always been a part of many cultures to fill free time. It is no surprise that educators would look to games as a method of imparting knowledge to others. Game-based learning has been proven to be an effective method to convey knowledge. In a study comparing the effectiveness of nutritional intervention leveraging social media and game-based solutions, the game-based interventions reported that those who played the games had an increased post-game knowledge of the topics (Nour et al., 2017). The study also reported that the game-based intervention had also resulted in an attitude change among the players, with the players losing weight and changing their dietary habits to eat more fruits (Nour et al., 2017). Hence, game-based learning is a viable method of education, with its effects bleeding into real life, resulting in the player developing new habits and attitudes.

2.2 Review of Existing Research

This section details three studies done on game-based learning approaches to educate their target users on financial literacy topics. The three articles reviewed in this section are “Digital Escape Games in Educational Programs for Financial Literacy” (Bisanti et al., 2022), “Using Gamification to Promote Financial Literacy and Consumer Education among Future Generations” (Estima & Peguinho, 2024), and “The Impact of an Online Game-Based Financial Education Course: Multi-country Experimental Evidence” (Cannistra et al., 2024). These studies are reviewed based on the game genre, the effectiveness of the approach and topics taught in the game.

2.2.1 Digital Escape Games in Educational Programs for Financial Literacy (Bisanti et al., 2022)

This research was done by Bisanti et al. in 2022 to evaluate the efficiency of learning financial topics through problem solving in an escape game, comparing the data between cooperative gameplay and solo gameplay. In this research, the score earned, time taken to finish the riddles, as well as pupil dilation were taken into consideration when evaluating the results of the research.

The game utilized in the research is named *Escape from the Castle*, a digital escape game designed to increase financial awareness among teenagers. The game was developed with the collaboration of the Museum of Saving in Turin, Italy, and the first experiment was conducted there. The premise of the game is that the players are to help the museum’s mascot escape from the castle, which is done by solving riddles in each room of the castle. There are four rooms, that being the lobby, the kitchen, the lounge area and the library, with each room containing a riddle related to a financial topic, such as savings and expense planning. The players have a time limit of 20 minutes to finish the game and are rewarded extra points if the game is cleared under 15 minutes. There are also 2 clues provided in each room however using them will dock points.

For the initial experiment, 118 students aged 11 to 14 years old were divided into two groups, the control group (solo gameplay) and the treatment group (cooperative gameplay), and were further divided to into groups of eight for the experimental session. Two students from each group were given eye trackers to record their pupil dilation. The game is played on an iPad that is provided to each student. The variables in the groups such as age and gender were not significant and did not contribute to the results of the experiment. The results show that the treatment group scored significantly better than the control group, however the time

used to play the game did not have any significant difference. As an addition, 40% of the treatment group were able to clear the game whereas only 15% of the control group were able to reach the game's end.

For the gamified retention phase, the students are allowed to play the game again online within a four-week period to reinforce their financial knowledge. The main difference between the online game and the game played in the initial experiment is that the riddles in the online game were randomly selected between three different versions for each room. The retention phase also included another part of the experiment, which was to compare the effects of incentives when playing an educational game. The treatment group were given a leaderboard that refreshes each week, and the top three scorers would obtain a prize, whereas the control group received none of those. In the results, only 20 of the 118 initial participants played the online version, 18 coming from the treatment group, and 2 coming from the control group. Although not many students played the game during the retention phase, those who did played at least twice. Upon analysing the gameplay during the retention phase, the average score increased significantly upon the players' second gameplay, suggesting that they have gained a better understanding of financial topics.

In conclusion, this research proves the effectiveness of using the escape game medium in educating teenagers on financial topics. The research also proves the importance of collaboration when solving puzzles in educational games as well as the motivational incentives provided when utilizing game-based learning increase financial literacy among its players. However, as the players had no access to learning materials that would help them clear the game, less than half of the participants were able to complete the game. This means that the game can only be cleared by those who already had the knowledge in the first place or were helped by those who do, making the game more like a test rather than a learning experience.

2.2.2 Using Gamification to Promote Financial Literacy and Consumer Education among Future Generations (Estima & Peguinho, 2024)

This paper details the development as well as the implementation of a game created to promote financial literacy and consumer education among students aged 12 to 18 years old. The game is named ISCA Family Game, where the participants will assume the roles of a family and manage their budget, simulating real life situations. The elements included in the game are made to be relatable to the participants while aligning with Portugal's National Plan for Financial Education objectives. The game is designed to include competition, collaboration as well as decision making to ensure players' engagement when playing the game.

Before playing the game, the participants will play a Kahoot quiz that contains basic financial topics. While the quiz is played, a finance specialist will explain the concepts to the participants.

Upon finishing the Kahoot quiz, the participants will be divided into groups and given personas which they will assume the roles of. As shown in Figure 2.1, each group will have a different persona that has different demographics, such as financial standing, cultural background, health conditions, and way of life. These groups are also given a monthly income as well as specific expenses, such as loans and insurances. The groups will then classify the expenses and create an analysis, done through creating a family budget and calculating the balance remaining after those expenses, and then determining the debt-to-income ratio.

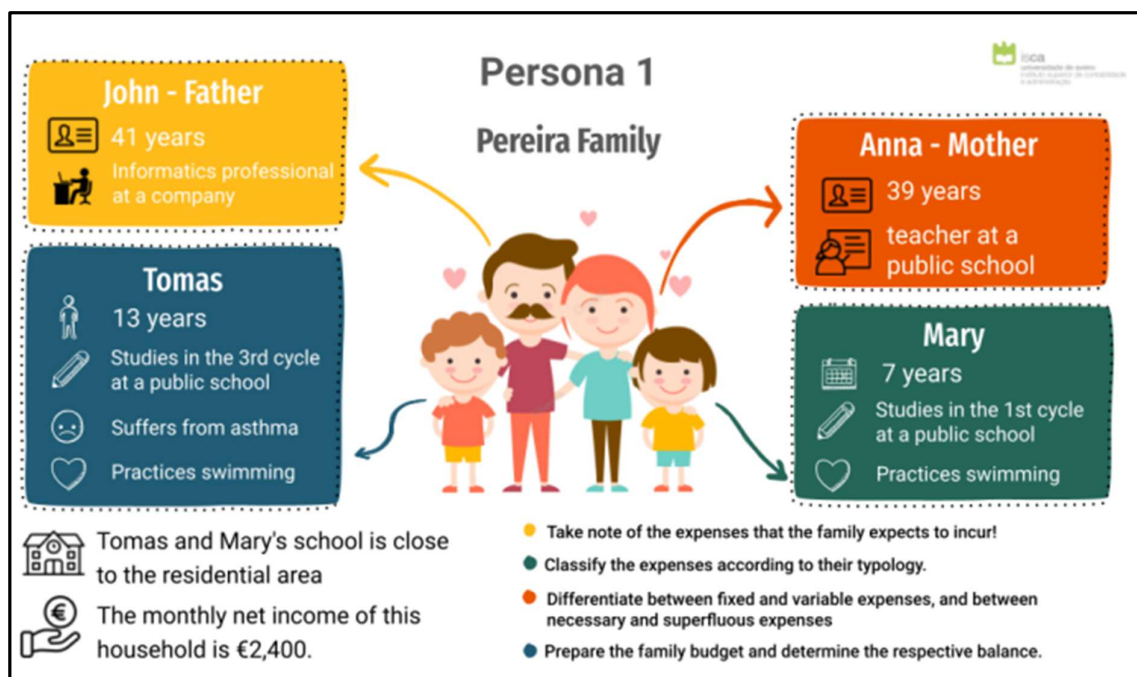


Figure 2.1 Screenshot of an example of persona provided (Estime & Peginho, 2024)

In the next part of the game, the groups are tasked with managing the personas grocery shopping. The groups are given a budget for the grocery, thus making the participants think carefully before buying items. In this phase, a marketing instructor will share tips about grocery shopping to the participants.

For the third phase of the game, the groups will evaluate the income of the family and their expenses, and then search for costs relating to the persona characteristics that may have been missed. The personas are then hit with an unexpected expense, such as plumbing issues or their

car breaking down. This prompts the groups to reevaluate their expenses and the budget they have created, and figure out how to accommodate the unexpected expense.

In the last phase, the groups will present their personas and explain the financial decisions made throughout the game as well as the strategies used to manage their personas finances. This part of the activity allows the participants to learn and understand other groups financial choices, as well as reflect on their own.

Overall, the game is a fun and interactive effort to educate teenagers on financial literacy as well as financial planning. The game motivates the participants to think critically when handling their expenses as well as fostering teamwork among the participants. The addition of the finance and marketing specialists also further educate the participants on finance concepts as well as tips that they can apply in real life. However, the study lacks an evaluation of its effectiveness in educating young adults on financial planning, as it would improve the game and to contribute to developing strategies to increase financial literacy among the youth.

2.2.3 The Impact of an Online Game-Based Financial Education Course: Multi-country Experimental Evidence (Cannistra et al., 2024)

This research aims to evaluate the impact of utilising an online game-based solution as a financial education tool to increase secondary school students' financial literacy. The research conducted by Cannistra et al. uses data from the Programme for International Student Assessment (PISA) to examine financial literacy in Belgium, Estonia, Italy and Slovakia, which are the countries targeted in the study. This data will be compared to the level of financial literacy of the control group and treatment group. Both groups are subject to a pre- and post-test, however the treatment group are allowed to play the online game in between the tests, whereas the control group are only given access after the post-test. The questions included in the tests are about inflation, compound interest and financial behaviour.

The online game is named *The Financial Escape Room*, which is developed according to a European project's framework about financial education. The students are able to access the game through a link given to them by their teachers, with the time they are able to access the game depending on their experiment groups. The students can access informational sheets for assistance during the game, ensuring that they are able to learn while completing the game.

The game has three parts that are played sequentially, each building on financial literacy concepts. The first part of the game requires them to gain a morse code to enter a bank. This is done by answering 18 questions regarding financial topics. These topics include means of

payment, bank accounts and managing them, understanding of inflation as well as basic interest calculations.

Upon entering the bank, they have to identify a bank employee who can guide the player to the bank vault's location. To identify the bank employee, they have to answer 10 questions regarding finance management, interest rates, or change calculations. With each question they solve correctly, they are given a hint to identify the employee. The game ends with 10 objective questions regarding means of payment. The students tend to take around 90 minutes to complete the activity on average.

The results of the post-test indicate that the students in the treatment group have improved their financial literacy. They also concluded that the impact the game provides depends on the financial literacy already possessed by the students, where the game impacted students from Belgium greatly, due to their low financial literacy scores in PISA, whereas the game had the smallest impact on the students from Estonia due to their high baseline literacy. Other factors that contribute to the impact of the game include demographics such as gender, native language as well as the presence of siblings in their families.

The study concludes that online, game-based financial education is an effective, scalable and cost-efficient method for improving financial literacy. The game expands on broader topics compared to the first two research papers, that only covers basic financial topics, therefore further preparing its players for adulthood. However, this study is rather ambitious due to the test subjects being from 4 different countries and thus having many different variables that would contribute to the results. This makes it difficult to evaluate the efficacy of the game itself.

2.3 Review of Existing Games

In this section, existing games that touch on financial literacy topics will be reviewed. The games reviewed in this section are The Uber Game, Hit the Road and Spent. These games will be reviewed based on the financial literacy content, the gameplay as well as the story,

2.3.1 The Uber Game

The Uber Game is a free-to-play web-based game developed by The Financial Times in 2017 and can be played both on desktop and on mobile devices as it is available to play on the Financial Times website (Blood et al., 2017). The game simulates the life of an Uber driver in San Francisco, based on real life interviews and reports by Uber drivers in the area. Figure 2.2 presents the title screen of The Uber Game.

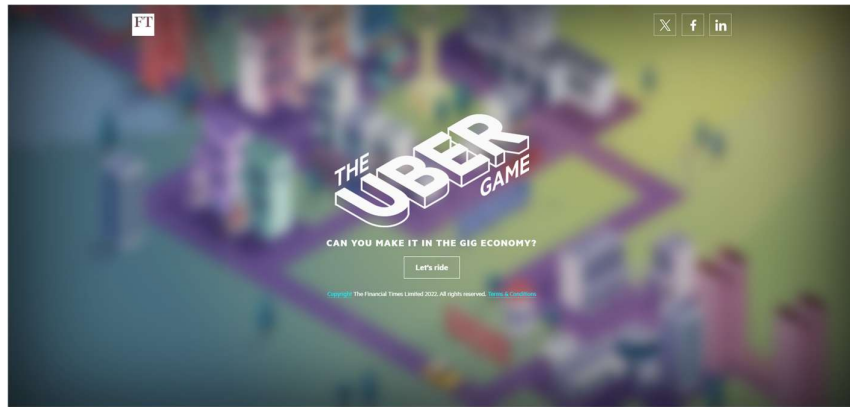


Figure 2.2 Screenshot of the Uber Game Title Screen (Financial Times, 2017)

The Uber Game is a visual novel where the player is an Uber driver that needs to earn enough money to pay off their mortgage within a week. Figure 2.3 shows the game screen, consisting of a background, a dialogue and a choice. The player progresses through the game by reading the text displayed and then selecting the buttons or choices presented. At the start of the game, the player will choose the city they live in, and what car they will drive. They are also given the choice to spend on extra items that would help with their journey as an Uber driver, such as a phone stand and unlimited data. All these choices will affect the earnings received and events that occur in the game.

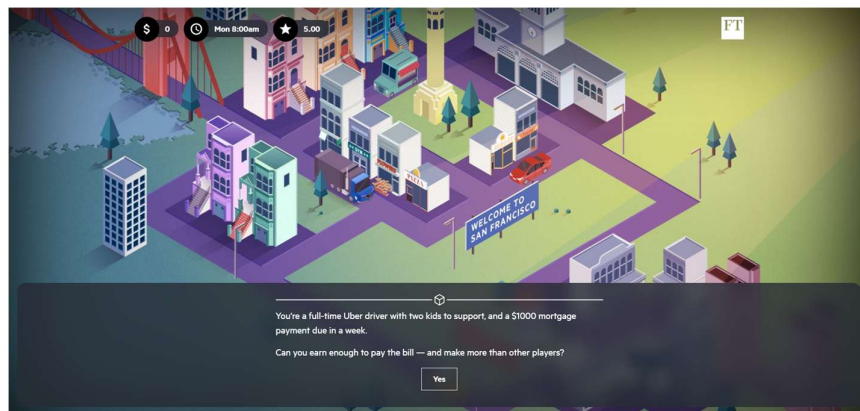


Figure 2.3 Screenshot of the Uber Game main game screen (Financial Times, 2017)

The game presents the players with events such as surge prices, passengers dripping food on the backseat, needing to repair certain parts of the car, and then presents choices for the player to select. These choices would later affect the players' earnings or expenditures. These examples are shown in Figure 2.4 and Figure 2.5.

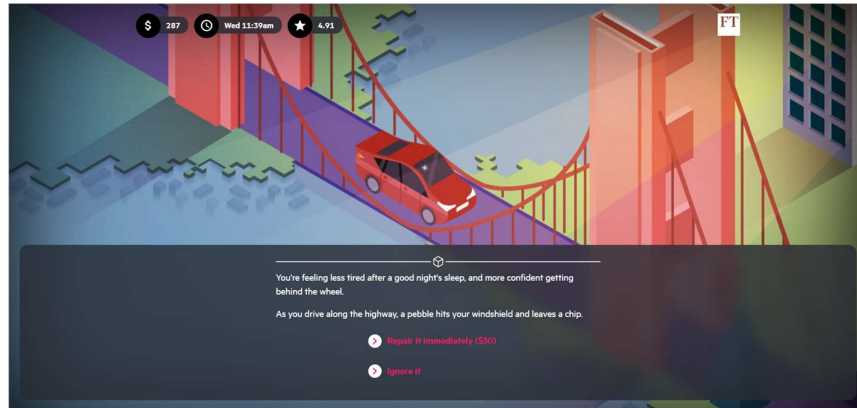


Figure 2.4 Screenshot of pebble event (Financial Times, 2017)

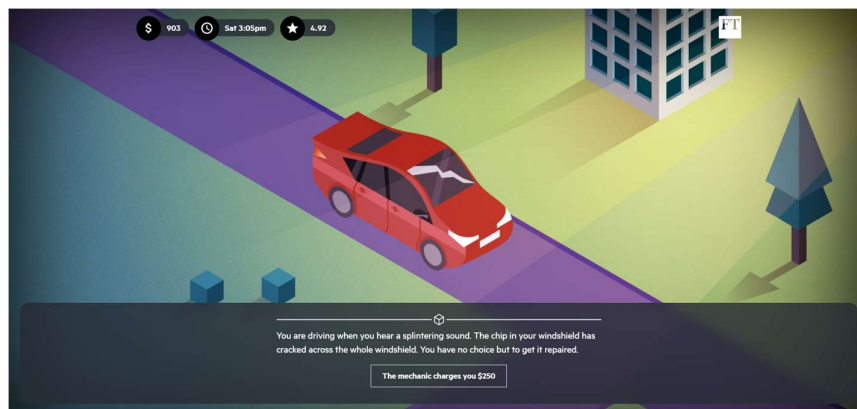


Figure 2.5 Screenshot of consequence for not fixing windshield (Financial Times, 2017)

In between the events, the game progresses by presenting the players earnings, how many rides they have done as well as how many more rides they need to be able to complete the quest given by Uber. As shown in Figure 2.6, the earnings and the rides displayed on the screen differ according to the choices made by the player in the previous event.

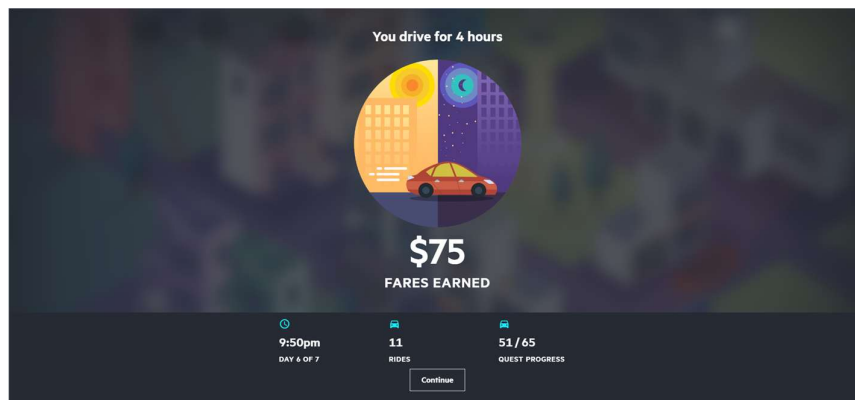


Figure 2.6 Screenshot of earnings screen (Financial Times, 2017)

There are two quests given by Uber, which is to complete a certain number of trips for the weekdays and on the weekends. Completing these quests will reward the player with extra money. Figure 2.7 displays the game screen when the day is completed along with the quest given by Uber.

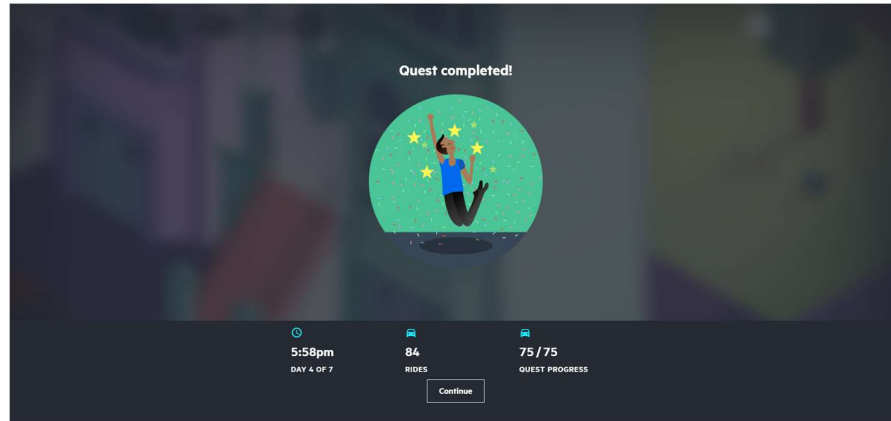


Figure 2.7 Screenshot of end of day screen upon completing quest (Financial Times, 2017)

At the end of the week, the game will display the players' statistics. Then, the player will be shown the money earned throughout the game along with the extra money earned from completing quests and bonuses depending on the car chosen. The game will then deduct the money used for renting the car, upgrading, and other costs incurred during the week. Once everything is calculated, the game will then inform the player whether they have reached the goal or not, as well as compare the earnings to the minimum hourly wage in California. Figure 2.8 displays the ending screen when the player fails to achieve the goal.

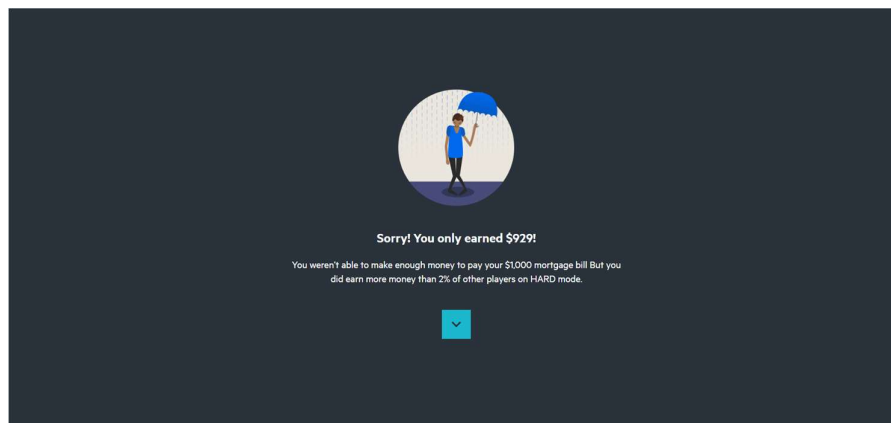


Figure 2.8 Screenshot of losing screen (Financial Times, 2017)

Overall, the Uber Game is a simple game that effectively communicates the difficulties of surviving in a gig economy. It also presses the importance of financial planning and how unexpected events can have big consequences. The game is aesthetically pleasing with bright colours and good illustrations, although the font size is quite small. The game itself does not educate the player on how to budget, rather focusing on allowing users to experience a reality where every action they take either earns them money or loses it, reinforcing the need for financial planning.

2.3.2 Hit the Road



Figure 2.9 Screenshot of Hit The Road title screen (National Credit Union Administration, 2013)

Figure 2.9 presents the title screen of the game Hit the Road, a free-to-play HTML5 game presented by the National Credit Union Administration released in 2013, aiming to teach young people the importance of planning finances and spending wisely (Jump\$tart Clearinghouse, 2024). The game is available to play on the National Credit Union Administration's website and includes a screen reader friendly version for the visually impaired.

In this game, the player character goes on a cross-country road trip with two other friends to go skiing in Colorado. While on this trip, the player and their companions will take the chance to visit various landmarks in America and gather souvenirs. However, the player must take care of the expenses of the group to ensure that they have enough money to buy food, gas, medicine and spare tires to continue the trip. The game starts with the player borrowing \$500 that needs to be paid off eventually, and upon reaching Colorado, the player must have accumulated at least \$500 to be able to rent skiing gear.

To acquire the funds needed for the trip, the characters will take on odd jobs at the places they visit. The jobs they can take depend on the professions the player has chosen for the characters to have. In Figure 2.10, the player is able to choose the profession, gender and name of the player character as well as the companion characters.



Figure 2.10 Screenshot of character selection screen (National Credit Union Administration, 2013)

Upon completing the character creation, the player is then shown the main game screen. As shown in Figure 2.11, the game informs the player of the location they are in, the jobs the player can take up and the things they can spend on. The jobs they are able to take will vary according to the location, as well as the items and activities they can spend money on. For the first location in the game, the player will visit a sightseeing location, where they can gain experience patches for certain activities done.

On the lower half of the screen, the player is able to view the characters, how many days they have been on the trip, the units of food, spare tires, medicine and spare gas in their inventory, as well as the amount of fuel in the car. The lower half of the screen also displays the money the player has in their checking balance as well as the remaining debt they need to pay off.



Figure 2.11 Screenshot of main game screen of Hit the Road (National Credit Union Administration, 2013)

Upon leaving the sightseeing location, a progress bar will appear on the top of the screen, as shown in Figure 2.12. The progress bar informs the player on where they currently are as well as the distance to the next location they will visit. The icons on the bar represent the type of location and allows the player to anticipate their next stop. Similar to sightseeing locations, non-sightseeing locations also allow the player to do odd jobs and spend money to buy necessities. Depending on the location, the types of necessities available will differ along with their prices. For example, at gas stations, the food usually costs around \$7 to \$8, whereas at a farm or a super store, the food would be \$4. With this information, the player can plan their expenses wisely. Figure 2.12 displays the layout of the screen when the player wants to buy from SuperMart.



Figure 2.12 Screenshot of buying screen (National Credit Union Administration, 2013)

Occasionally, one of the characters will fall ill or the car will have a flat tire. In order to prevent the higher cost of nursing the character back to health or to have the tire fixed, the player should have medicine and spare tires on hand at all times. As shown in Figure 2.13, if the player has medicine on hand when a character falls ill, one unit of medicine is consumed, and the road trip continues as usual. However, without those necessities, the player will be sent backwards to the nearest location that can fulfil it. When the player runs out of food, the game will send the characters back to the last place they could buy food. Similarly, when the car runs out of fuel and the player did not buy gas insurance, the player will be sent backwards to the nearest gas station while also paying a fee. In short, failing to meet the characters needs will result in a penalty, through paying an extra fee, undoing the progress of the road trip or both at the same time. This game mechanic enforces the importance of planning ahead and being prepared for unexpected events.

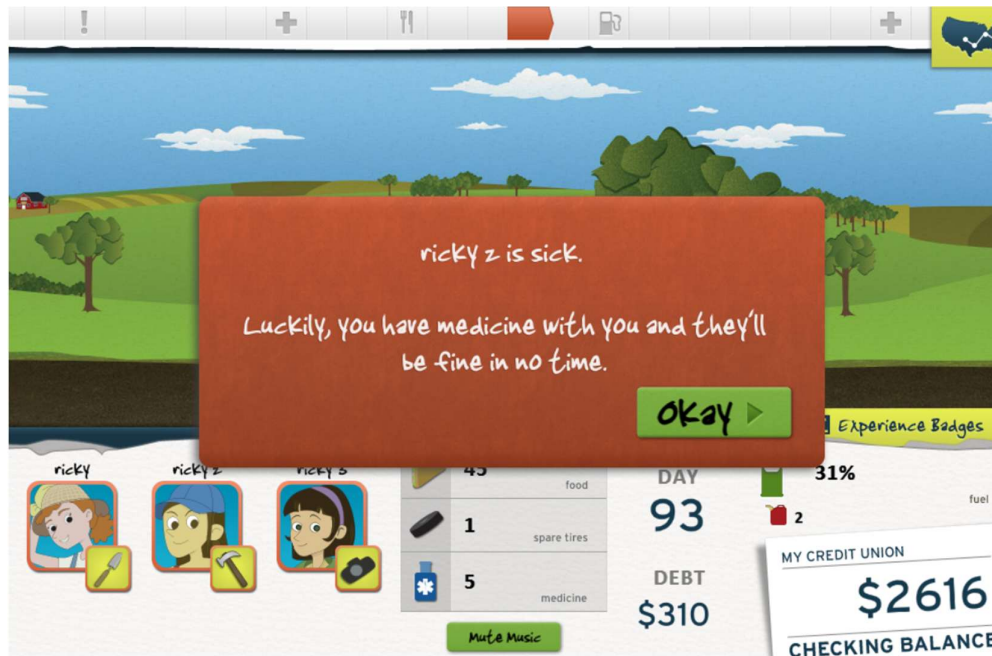


Figure 2.13 Screenshot of sick event (National Credit Union Administration, 2013)

Upon reaching the end of the road trip, the player is presented with a report card of how well they managed their expenses while also being able to fully experience the activities available during the trip. They are given points for certain milestones they achieved in game and are then rated on a 5-star scale. This report card is shown in Figure 2.14.

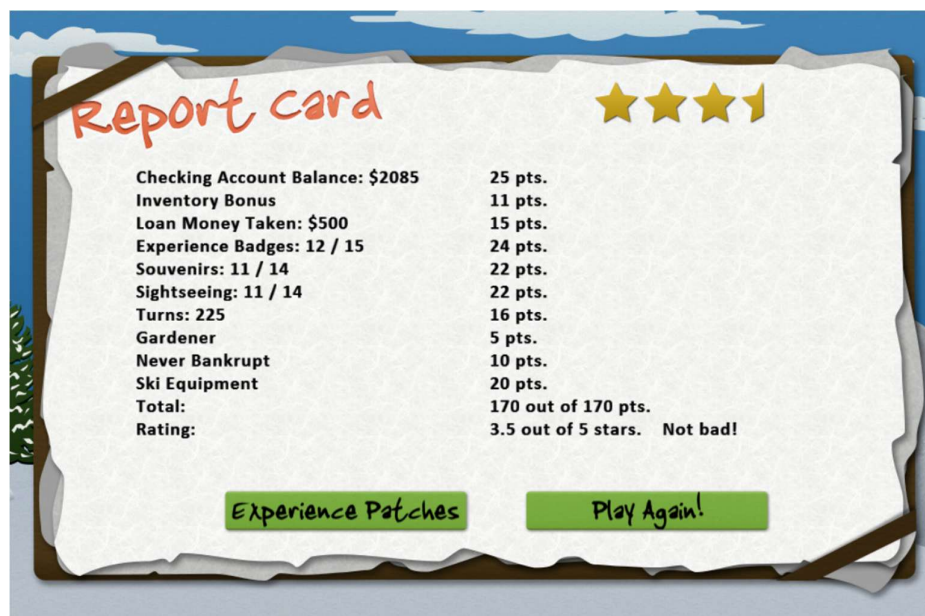


Figure 2.14 Screenshot of report card screen (National Credit Union Administration, 2013)

Overall, Hit the Road communicates the need of financial planning and budgeting through the simple and straightforward gameplay. However, the repetitiveness of gameplay might be boring to some, and the handwriting font choice is rather hard to read.

2.3.3 Spent

Spent is a free web browser game developed by the advertising agency McKinney for Urban Ministries of Durham (McKinney, 2014). The game is an online poverty simulator, where the player must make difficult financial decisions to be able to survive with only \$1000 a month. In the game, the player character is an unemployed parent who has lost their house and has no savings other than the \$1000 they have left. The opening screen for the game is displayed in Figure 2.15.

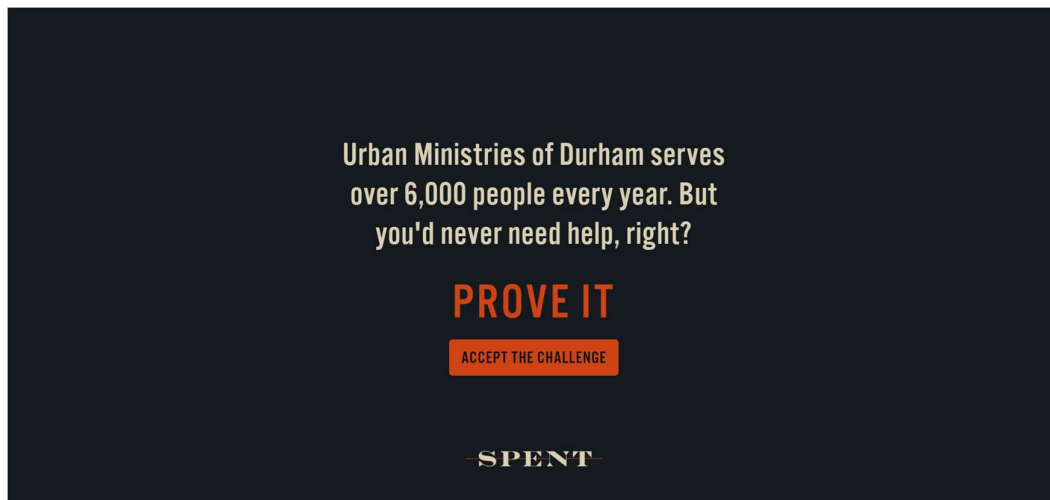


Figure 2.15 Screenshot of Spent opening screen (Urban Ministries of Durham, 2011)

Upon starting the game, the player is presented with three different job options, all three only paying minimum wage, as shown in Figure 2.16. Upon selecting a job, the game breaks down the salary, presenting the salary before and after taxes as well as extra fees, as displayed in Figure 2.17. Lastly, it shows the salary the player will receive every week. On the right of the screen is the calendar for the month, with paydays represented with a dollar sign next to the date. On the left, there are 3 Xs that will be coloured red with each job strike the player receives, with the third job strike leaving the player jobless. Below the job strikes, there are other options to gain money which are taking money from the player's son's piggy bank, donating plasma, and taking a loan.



Figure 2.16 Screenshot of Job Selection (Urban Ministries of Durham, 2011)

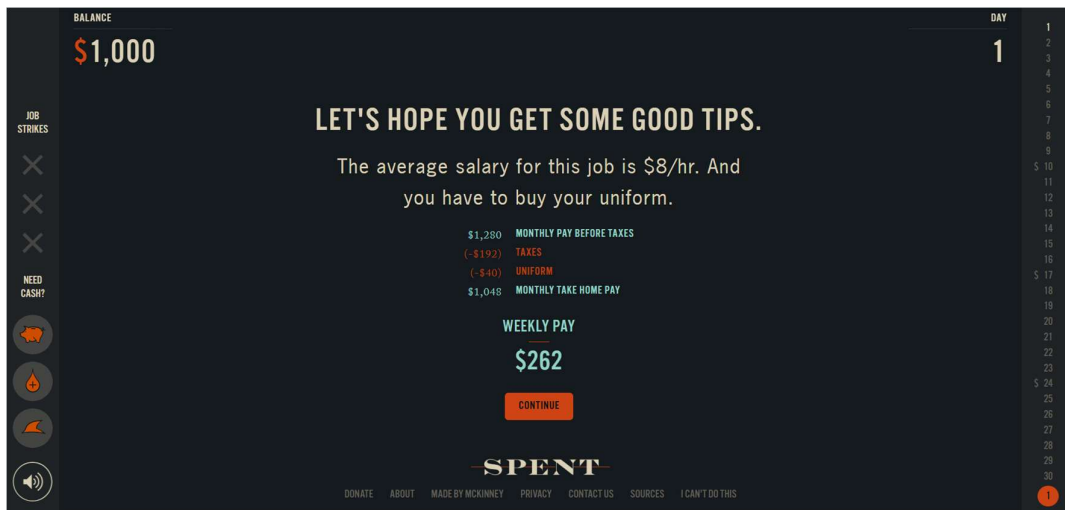


Figure 2.17 Screenshot of salary breakdown (Urban Ministries of Durham, 2011)

After selecting the job, the player will then choose a health insurance plan, which will take up a huge chunk of the player's salary. Then the player must choose where to live, where they will use a slider to adjust the house's distance from their place of work. The rent of the house will reduce the farther it is from the city, but the travel costs will increase. This is shown in Figure 2.18.

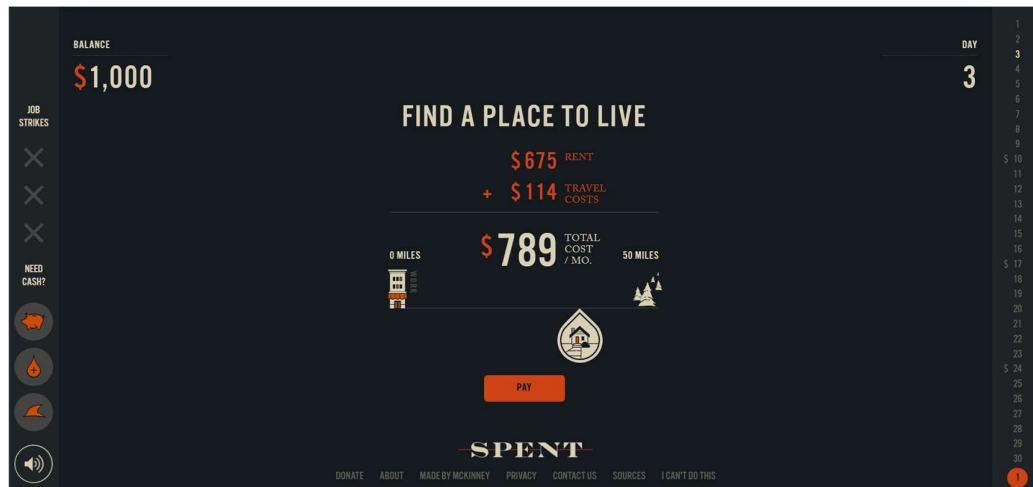


Figure 2.18 Screenshot of place to live choice (Urban Ministries of Durham, 2011)

Throughout the game, the player is given scenarios and must make decisions to survive the month. Some of the decisions are simple such as choosing to sell some of your items and choosing what to buy for groceries. The player will also be presented with difficult situations, for example choosing to pay for the player's mother's medication or choosing the fate of the family pet, and making the moral choice is difficult when the player is unable to afford it, as shown in Figure 2.19.

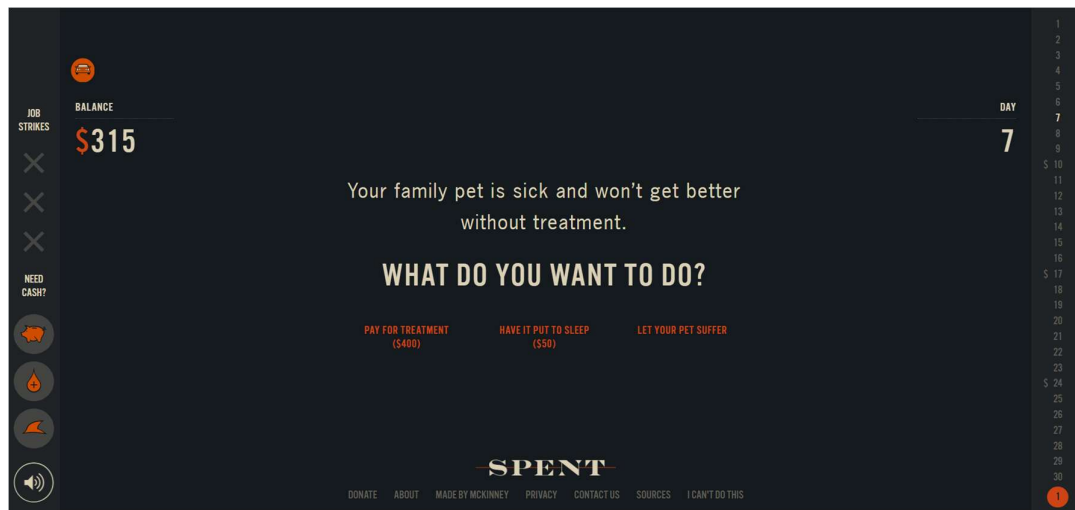


Figure 2.19 Screenshot of choice screen (Urban Ministries of Durham, 2011)

Upon making a choice, the player will either be presented with the consequences of their actions, or a statistic about poverty relating to the decision made. This is shown in Figure 2.20.

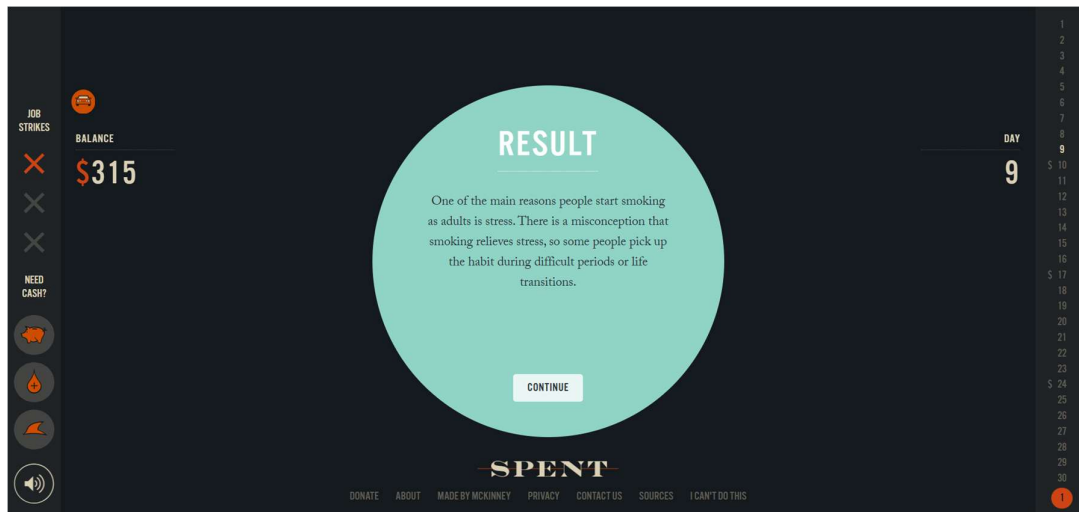


Figure 2.20 Screenshot of result screen (Urban Ministries of Durham, 2011)

The game ends when the player has run out of money or has reached the end of the month, reminding the user that they still need to pay rent the next day. The game end screen also urges the player to donate \$10 to Urban Ministries of Durham. The game's end screen is displayed in Figure 2.21. Overall, although the game's focus is poverty awareness, the game also urges the player to be mindful of their expenses as well as serves as a reminder of the importance of making smart financial decisions. As the game focuses on poverty awareness, the game does not teach the players on how to manage money properly when faced with poverty, but rather invites the player to empathise with those who suffer from poverty.

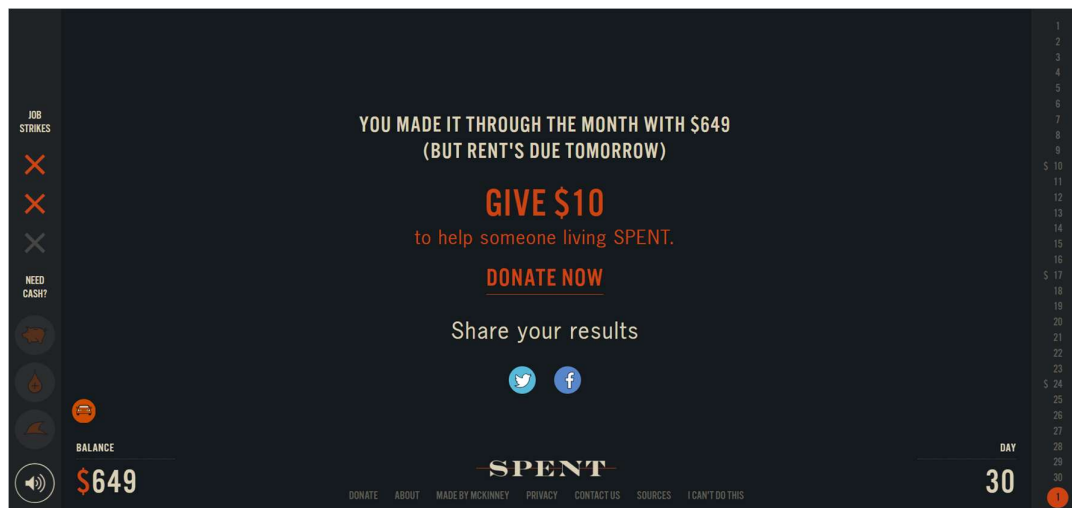


Figure 2.21 Screenshot of game ending screen (Urban Ministries of Durham, 2011)

2.4 Comparison between Existing Research and Proposed Research

Table 2.1 Comparison between Existing Research and Proposed Research

Research Title	Author	Year	Game Name	Target Users	Type of Game	Topics Covered	Experiment Design
Digital Escape Games in Educational Programs for Financial Literacy	Bisanti et al.	2022	Escape from the Castle	Students aged 11 to 14 years old	Digital escape room, using riddles	Savings and expense planning	Scores obtained in game
Using Gamification to Promote Financial Literacy and Consumer Education among Future Generations	Estima & Peguinho	2024	ISCA Family Game	Students aged 12 to 18 years old	In person role-playing game	Budgeting and expense planning	None
The Impact of an Online Game-Based Financial Education Course: Multi-country Experimental Evidence	Cannistra et al.	2024	The Financial Escape Room	Secondary school Students in Belgium, Estonia, Italy and Slovakia	Online escape room, using quizzes	Inflation, finance management, bank account management and interest	Pre and Post test
“I <3 Money”, Teaching Budgeting Basics Through Game-based Learning	Huda Nadhirah binti Saiful Bahtiar	2025	I <3 Money	Young adults aged 18 to 25 years old	Educational Strategy Adventure RPG	Budgeting	Pre and Post test

Table 2.1 presents a comparison of the existing research reviews as well as the proposed research. They are compared according to the target users, the type of game, the topics covered and the experiment design.

The first aspect, target users, refers to the demographic of the users that were tested in the experiments. The digital escape room game, *Escape from the Castle*, was tested on students who were aged 11 to 14 years old whereas *ISCA Family Game* is played by students aged 12 to 18 years old. The *Financial Escape Room*, on the other hand, was tested by secondary school students in Belgium, Estonia, Italy and Slovakia. The large demographic of the target users for the *Financial Escape Room* is not preferable as the results would be unclear. Therefore, it is important to ensure that the demographic of players do not interfere with the results reliability.

The type of game refers to the genre of the game involved in the research. *ISCA Family Game* is a role playing game, as the players assume the roles of members of a family in the game. *Escape from the Castle* and *The Financial Escape Room* are both escape games, however, *Escape from the Castle* implements riddles and puzzles into the gameplay, whereas *The Financial Escape Room* relies on quizzes for its puzzles. When compared, the *ISCA Family Game* simulates the process of creating a budget and doing financial planning, as opposed to *Escape from the Castle* and the *Financial Escape Room*. In this aspect, the proposed research is similar to that of *ISCA Family Game*. However, *ISCA Family Game* is only available to play in person and within groups, limiting the game's availability, unlike the other two online games.

The topics covered aspect refers to the financial topics that are taught within the game. *Escape from the Castle* integrates expense planning and developing savings as part of the game. *ISCA Family Game*, on the other hand, focuses on expense planning and budgeting for family needs. The *Financial Escape Room* differs from the two previous games as it delves into more complex topics, such as inflation, interest, bank account management as well as financial management. All three games have covered topics that are relatable to the target user demographic. This detail is important to ensure that the player is able to learn according to their financial literacy level and eases the player into understanding the topics presented.

The experiment design refers to how the experiments and results were evaluated. *Escape from the Castle* relies on the scores obtained by its players, that are influenced by the time taken to complete the puzzles as well as the number of hints used. The *Financial Escape Room* utilizes pre and post-tests, with the control group not playing the game at all when doing the tests, whereas the treatment group played the game before proceeding to the post test. On the other hand, *ISCA Family Game* did not do any evaluation for their game, as the article only details the game creation process and the game itself. The method of evaluation is important as

it ensures the results align with the type of data that the research aims to discover. It is also important to have an experiment design in order to evaluate the effectiveness of teaching financial literacy topics through game-based learning.

2.5 Comparison Between Existing Games and the Proposed Game

Table 2.2 Comparison Between Existing Games and Proposed Game

Title	Developer/Publisher	Genre	Platform	Topics Covered
The Uber Game	The Financial Times	Educational visual novel	HTML5	Financial planning, gig economy
Hit the Road	National Credit Union Administration	Educational strategy game	HTML5	Financial planning, budgeting, resource management
Spent	McKinney, Urban Ministries of Durham	Educational simulation game	HTML5	Poverty, financial planning
I <3 Money	Huda Nadhirah binti Saiful Bahtiar	Educational Strategy Adventure Role-Playing Game (RPG)	HTML5	Budgeting

Table 2.2 presents the comparison between the three existing games reviewed and the proposed game. The comparison is based on the genre, platform, and topics covered.

The genre aspect refers to the genre of the game. The Uber Game chooses the visual novel genre where the player is directly referred to when events happen and when choices need to be made. Similarly, Spent utilizes their simulation genre to allow the users to artificially experience the content delivered in the game. On the other hand, Hit the Road is a strategy game, where the player has to plan their expenses and manage their resources in order to reach the end of the road trip. The proposed game, I <3 Money, will utilize a narrative driven game to allow the player to immerse themselves in the worldbuilding, therefore enhancing the learning experience. The proposed game will be a strategy adventure role-playing game (RPG), a popular game genre, allowing the game to reach a wide audience while gamifying the process of budgeting into a strategy gameplay.

Platform refers to the platform the game is available to be played on. All three of the reviewed games are HTML5 games, or in other words, they are all available to be played on a web browser. Using the HTML5 platform allows the game to be accessible to most, as it only requires using a web browser. Therefore, the proposed game will also be a web-based game.

The topics covered refer to the financial topics and themes conveyed in the games. The Uber Game tells a story of the difficulties of surviving in a gig economy, while the player makes financial management decisions. Spent, on the other hand, focuses on the struggle of managing finances and making smart financial decisions when in poverty. In hindsight, both of these games focus less on conveying financial management knowledge but rather focus on the awareness of the importance of money, as well as the hardships faced by the people the player character is based on. However, Hit the Road puts a focus on resource management, budgeting and financial planning, with the player actively managing the expenses made. As understanding financial management as well as its importance comes hand in hand, the proposed game aims to educate its players on budgeting and its importance.

2.6 Brief Overview of Proposed Project

The proposed game, I <3 Money, is planned to be an educational strategy adventure RPG aimed towards young adults. The game aims to educate young adults on the importance of budgeting and recommended budgeting practices. The players will learn about the concepts of budgeting as well as debt management through budgeting, as the target audience's age range are similar to most fresh graduates who will have student debt. This is done by utilizing the main character's story and inserting financial struggles that align with the topics included in

the game. The game will be developed using Godot and will be published as a web-based game. The Godot game engine is chosen as it is lightweight and easy to use, whereas having the game available to be played on a web browser will make it accessible to many people. The game will be in English as it is a worldwide lingua franca.

The proposed research, “I <3 Money, Teaching Budgeting Basics Through Game-Based Learning”, will focus on developing a game-based learning approach to teach young adults about budgeting. The research aims to evaluate the effectiveness of educating young adults on the basics of budgeting through the medium of digital games. In order to achieve this goal, the method of evaluation will be conducting pre- and post-tests on the participants.

2.7 Summary

This chapter details reviews of three different types of existing research on the development of game-based learning approaches for financial literacy. The chapter also includes reviews on three different games that educate on different aspects of financial literacy. Comparisons between the reviewed research and the proposed research, as well as the reviewed games and the proposed game has been drawn to discuss their characteristics that can be implemented into the proposed game.

CHAPTER 3: REQUIREMENT ANALYSIS AND DESIGN

3.1 Introduction

This chapter details the requirement analysis and design for the project. Requirement analysis and design is an important step when creating a project as it allows the project to be planned properly, ensuring the development and deployment of the project goes smoothly and its aims to be achieved. In order to achieve this, it is crucial to select an appropriate methodology for the project.

3.2 Outcome-based Methodology

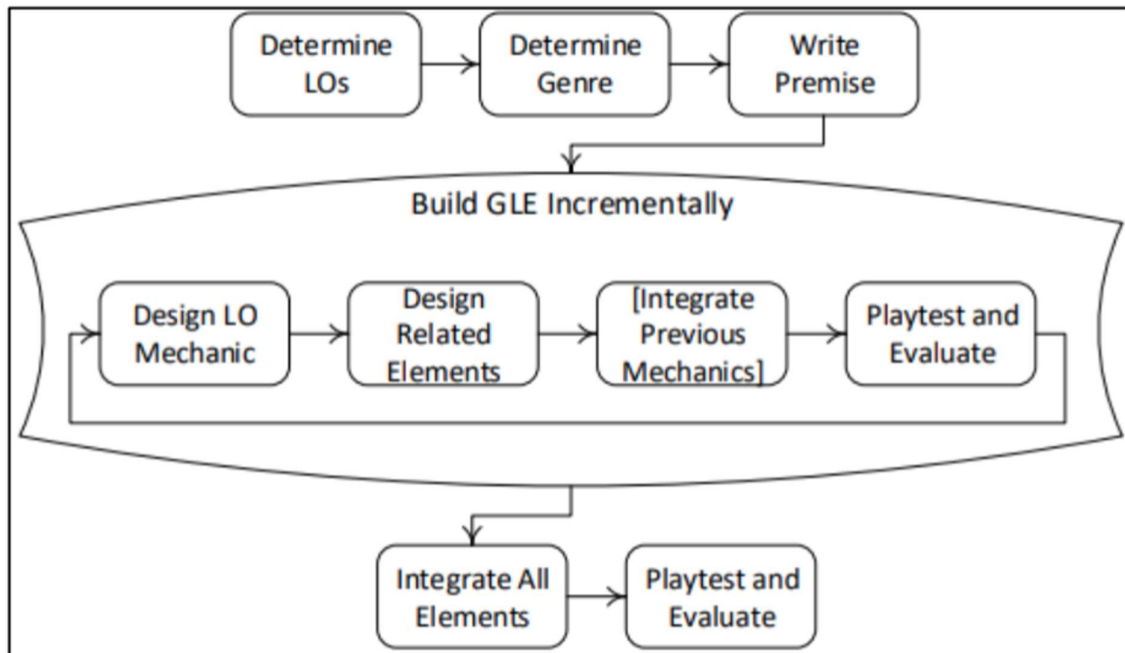


Figure 3.1 Outcome-based methodology (Sison et al., 2018).

The methodology applied for this project is the outcome-based methodology by Sison et al., 2018. This methodology is made up of nine steps, with four steps executed iteratively, in order to create a game-based learning environment that is able to achieve its LOs. The nine steps are as follows:

- 1) Determine LOs
- 2) Determine the genre of the game

- 3) Write the game's premise
- 4) Designing the LO mechanic
- 5) Design the related elements for the mechanic
- 6) Integrate the previously designed mechanics
- 7) Playtest and evaluate the mechanic
- 8) Integrate all elements
- 9) Playtest and evaluate the game as a whole

Adhering with the methodology steps, a survey was conducted. The survey covers the respondents' understanding of financial topics as well as their financial habits. Which will help in the first step of the methodology; determining the LOs. The survey also includes a section regarding the respondents' interest in games and their preferred game genre, which will guide the second step of the methodology; determining the genre of the game.

A. Survey

Prior to the steps outlined in the outcome-based methodology, a survey was conducted to get a better understanding of the mindset of young adults when it comes to money management, and what can be improved. The survey also serves to gain more information on what content should be included in the game.

The survey was developed and distributed using Google Forms. On the first page of the Google Form, the participants are provided a consent form. In the consent form, the participants are informed of the purpose of the survey as well as ensuring that their participation in the survey is voluntary, and their anonymity will be maintained. If the participant agrees with the terms, they are then able to answer the survey. The consent form and survey are included in Appendix C.

In total, 31 respondents had participated in the survey. There are a total of 22 questions, 20 of them being closed ended, and two open ended questions. The survey is divided into four sections, Section 1: Demographic Information, Section 2: Financial Habits and Challenges, Section 3: Financial Knowledge, and Section 4: Gaming Preferences and Feedback.

Section 1: Demographic Information

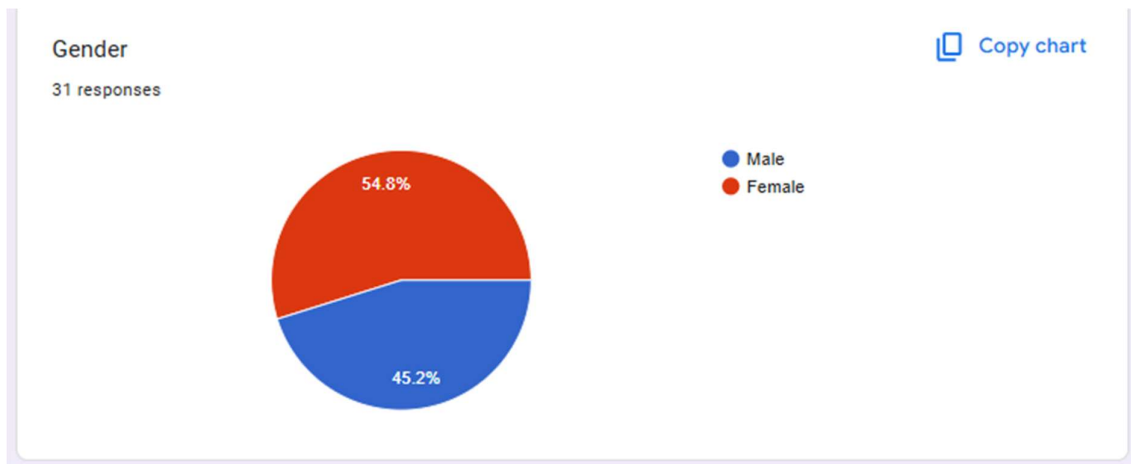


Figure 3.2 Gender of respondents

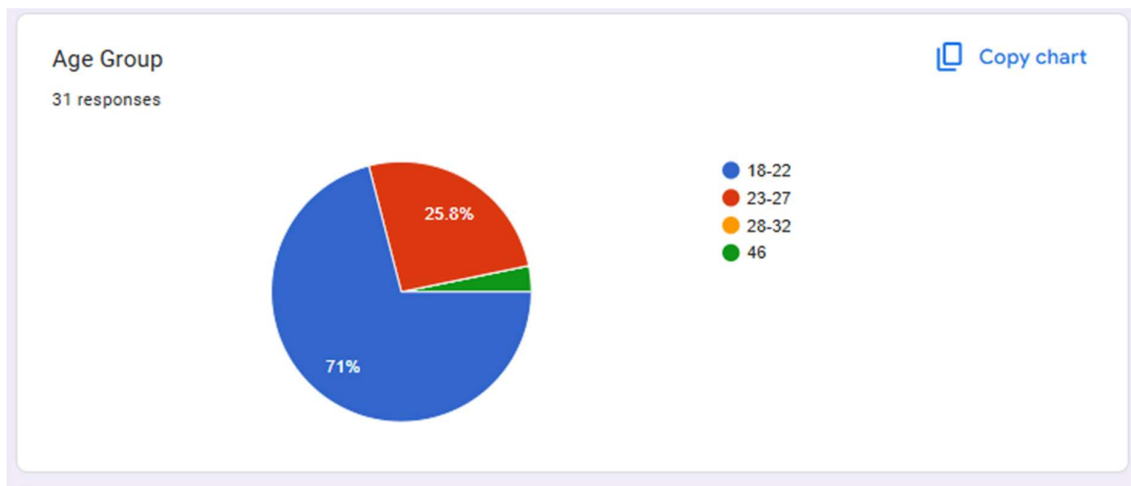


Figure 3.3 Age group of respondents

According to Figure 3.2, the genders of the respondents are almost equally split between male and female, with 54.8% of the respondents identifying as female and 45.2% identifying themselves as male. In Figure 3.3, the majority of the respondents are 18 to 22 years old, making up 71% of the respondents. 25.8% of the respondents are between the age 23 and 27 years old and only one respondent (3.2%) had reported themselves to be 46 years old. It is unclear why they participated when the survey was specified to be for young adults.

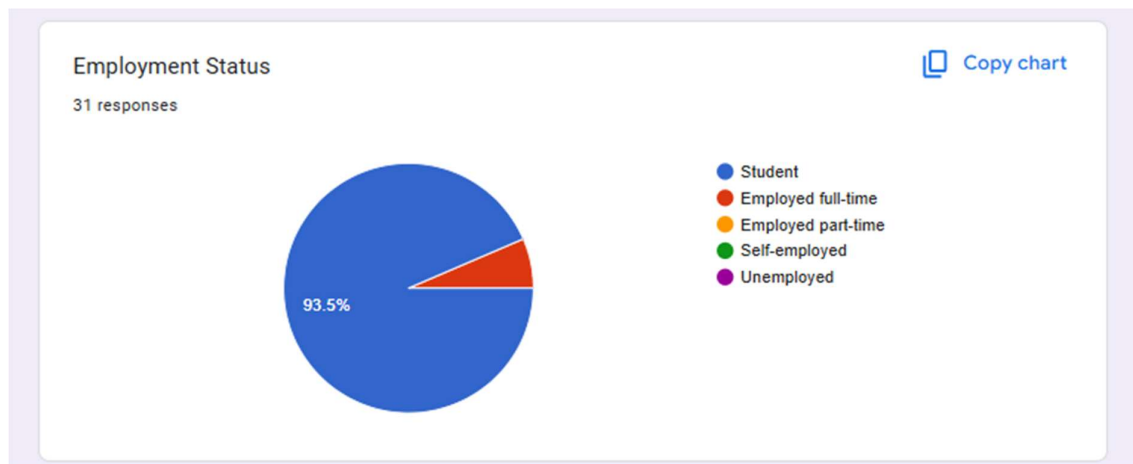


Figure 3.4 Respondents' employment status

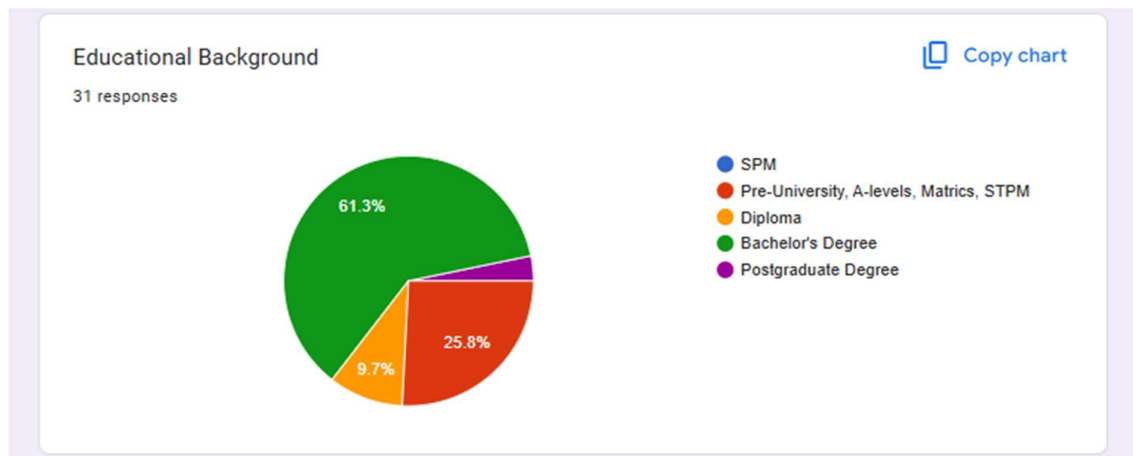


Figure 3.5 Respondents' level of study

According to Figure 3.4, 93.5% of the respondents were reported to be students. The remaining 6.5% are full-time employees. In Figure 3.5, most of the respondents have a bachelor's degree (61.3%), followed by respondents who have completed their pre-university studies (25.8%), followed by 9.7% of respondents who have completed their diploma. Only one of the respondents had completed their post graduate studies, making up 3.2% of the respondents.

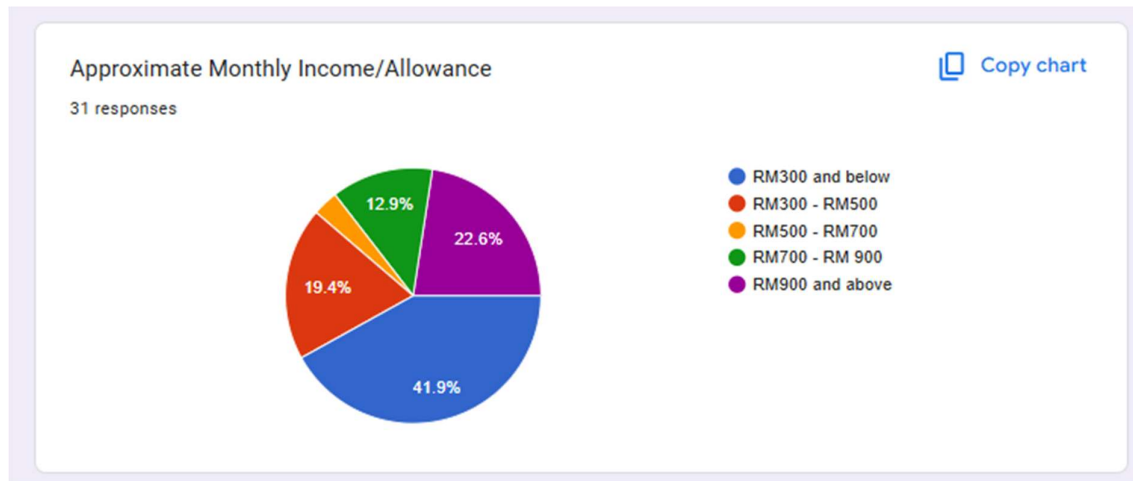


Figure 3.6 Respondents' monthly income

The data in Figure 3.6 displays the approximate monthly income or allowance received by the respondents. 41.9% of the respondents report that they receive RM300 and below per month, making up most of the respondents. The second largest group of respondents reported that they receive RM900 and above per month, making up 22.6% of the respondents. 19.4% of respondents receive an allowance of RM300 to RM500 per month, whereas 12.9% of respondents have a monthly income or allowance of RM700 to RM900. Only 3.2% of the respondents receive RM500 to RM700 per month.

Section 2: Financial Habits and Challenges

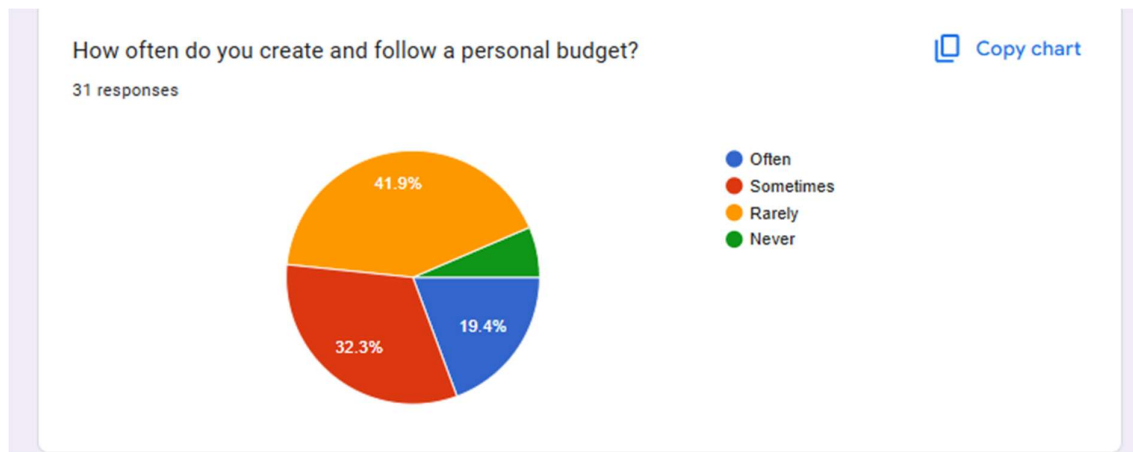


Figure 3.7 Respondents' personal budgeting habits

According to Figure 3.7, the respondents reported their habit of budgeting. A large number of respondents reported to rarely follow a personal budget, making up 41.9% of the respondents. 32.3% of the respondents reported to sometimes create and follow a personal

budget and 19.4% of the respondents make it a habit to do so. Concerningly, 6.5% of the respondents have never created or followed a personal budget.

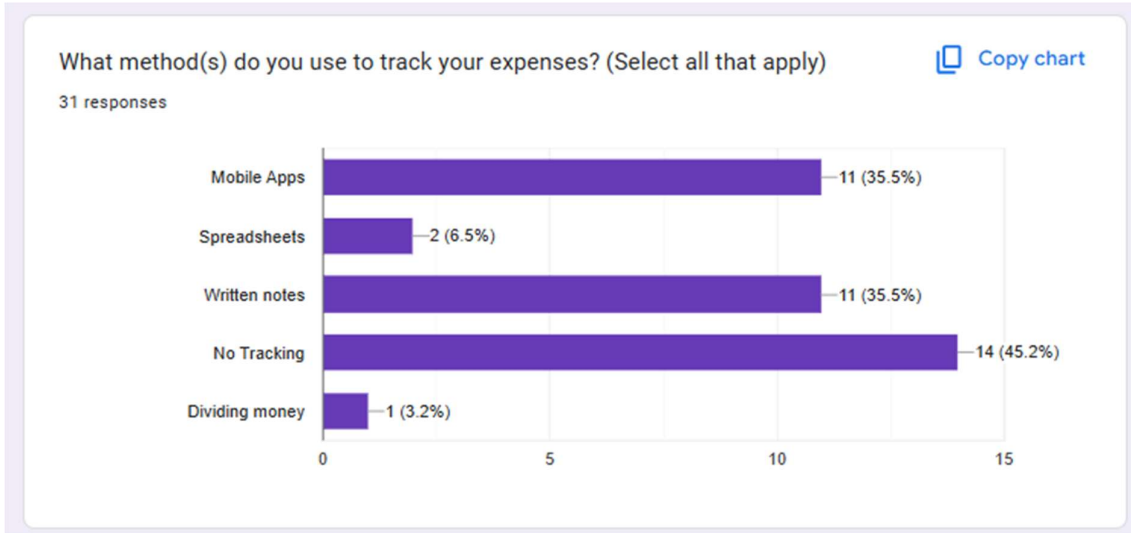


Figure 3.8 Respondents' expense tracking methods

In Figure 3.8, the data shown depicts the answers by respondents when asked how they track their expenses. The highest selected answer is “No Tracking”, making up 45.2% of the answers. Tracking expenses using mobile apps and written notes are both the second most popular answer, making up 35.5% of answers each. 6.5% of the answers were tracking expenses using spreadsheets, and there was one answer for dividing money.

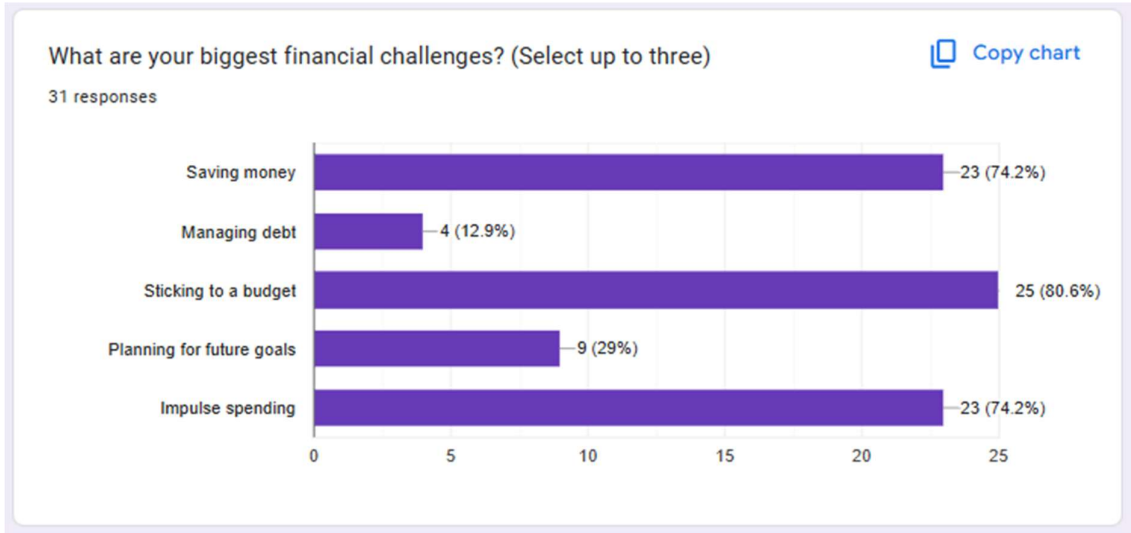


Figure 3.9 Respondents' main financial challenges

In Figure 3.9, the respondents answered what are their biggest financial challenges. The data shows that most struggle with sticking to a budget, with 80.6% of respondents selecting

the option. 74.2% of respondents selected saving money and impulse spending as their greatest financial challenges. Planning for future goals was only selected by 29% of respondents and managing debt was the least selected option, with only 12.9% of respondents selecting it. This may indicate that most respondents do not have debt, or they do not plan for future financial goals.

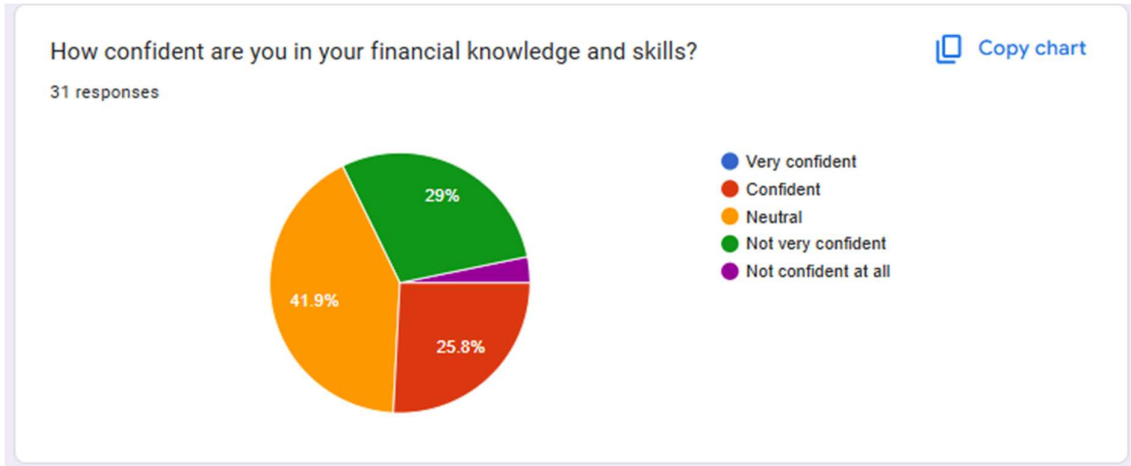


Figure 3.10 Respondents' confidence in their financial knowledge and skills

According to Figure 3.10, 41.9% of respondents reported that they have a neutral confidence in their financial knowledge. 29% of respondents claim to not be very confident in their financial knowledge whereas 25.8% claim to be confident. Only one of the respondents (3.2%) admitted being not confident at all in their financial knowledge. Based on these answers, it can be said that most of the respondents of this survey do not have much confidence in their financial knowledge.

Section 3: Financial Knowledge

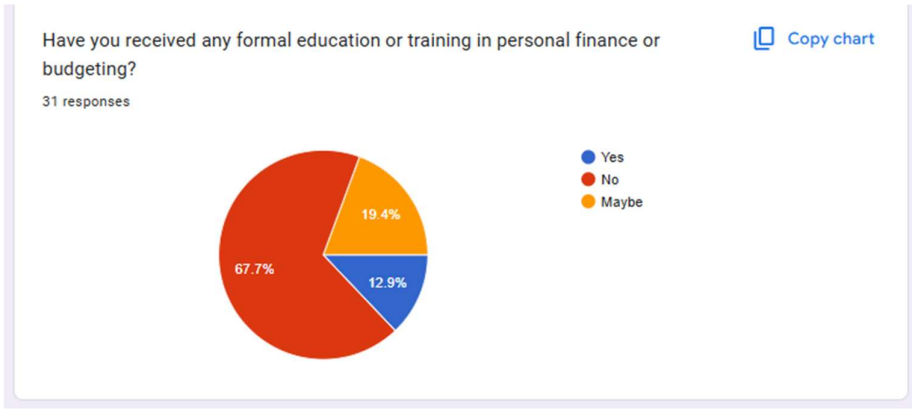


Figure 3.11 Respondents' personal finance education

In Figure 3.11, the pie chart reveals that most of the respondents do not have formal education or training in personal finance or budgeting, making up 67.7% of the answers. 19.4% of the respondents are unsure whether they received formal education regarding personal finance, whereas 12.9% of respondents have received formal personal finance training. The number of respondents who have not received formal education in personal finance aligns with the low confidence in financial knowledge amongst respondents.

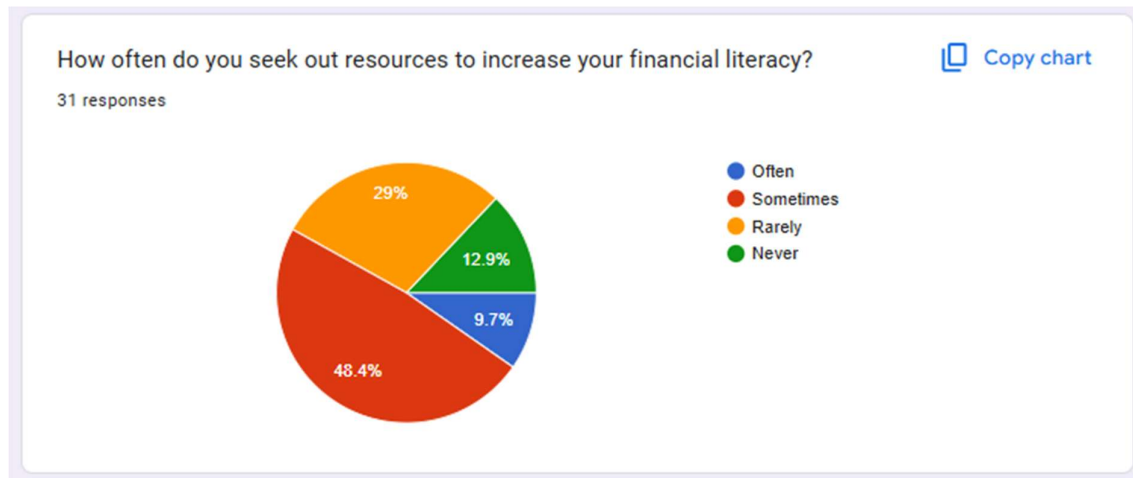


Figure 3.12 Respondents' habit of seeking financial literacy resources

In Figure 3.12, almost half of the respondents would occasionally seek out financial literacy resources, making up 48.4% of respondents, followed by 29% of respondents who would rarely seek out financial literacy resources. There are more people who never seek out resources to increase their financial literacy compared to those who often seek them out, with 12.9% of respondents choosing the “Never” option, and 9.7% of respondents choosing the “Often” option. This data indicates that most respondents are interested in increasing their financial literacy.

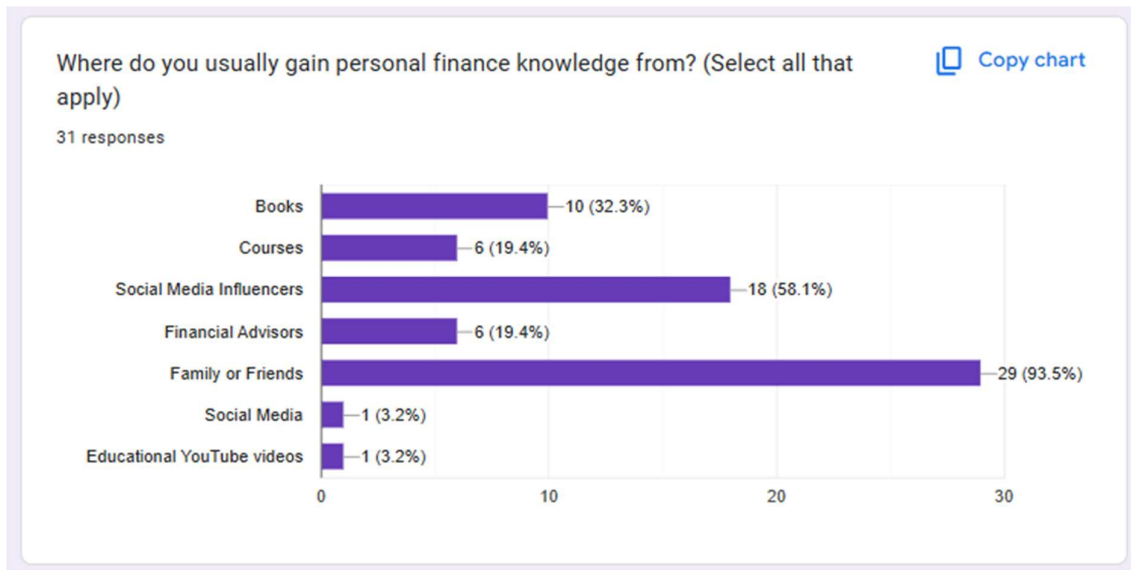


Figure 3.13 Respondents' source of financial knowledge

Figure 3.13 depicts the answers of respondents when asked where they gain personal finance knowledge from. Nearly all of the respondents gain their personal finance knowledge from family or friends, with 93.5% of respondents selecting the option. The second highest selected option is from social media influencers, being the answer of 58.1% of respondents. The third highest ranked option is gaining financial knowledge from books, with 32.3% of respondents selecting the option. From this question, it is clear that although most do not have formal financial education, they still gain financial knowledge informally.

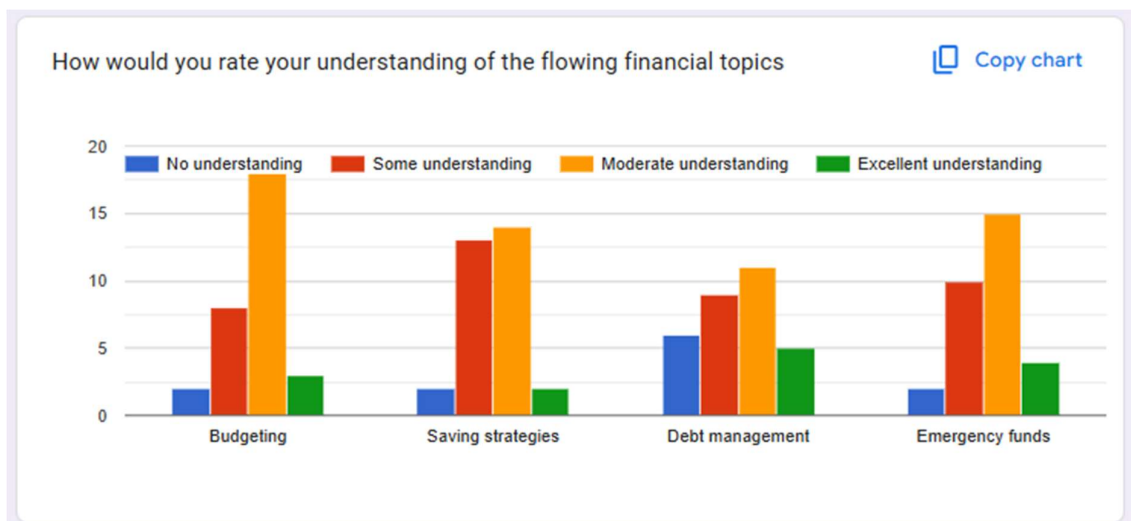


Figure 3.14 Respondents' rating of their understanding of financial topics

Figure 3.14 depicts respondents understanding of certain financial topics. According to the answers, the least understood topic is debt management, followed by saving strategies, followed by emergency funds, and lastly, budgeting. As most of the respondents are still students, they have not experienced debt which explains the low score for debt management in Figure 3.9, however the lack of understanding on debt management is concerning considering they will eventually have to take loans in the future.

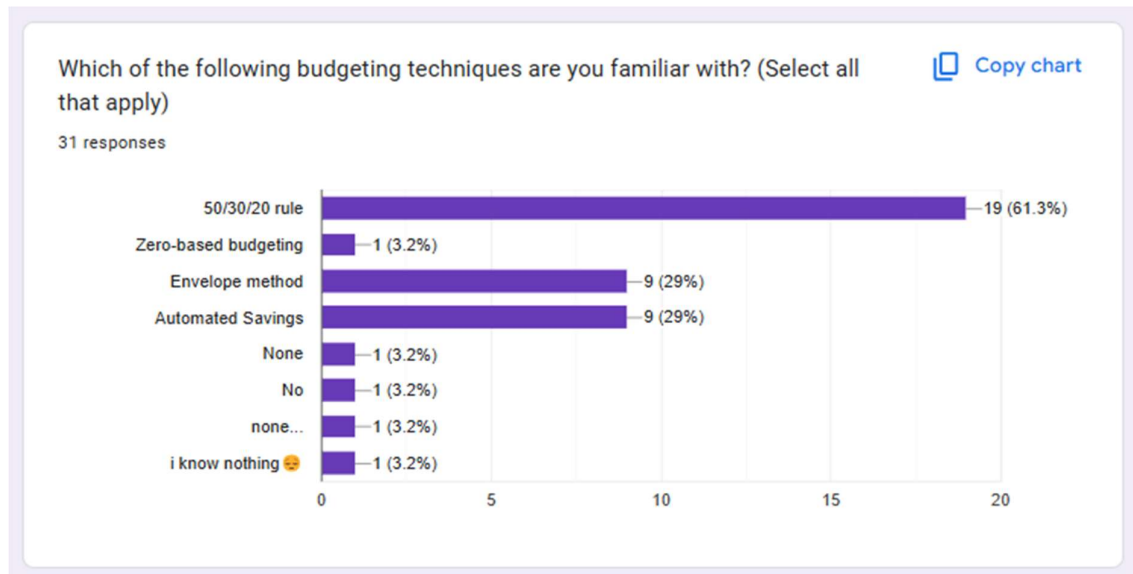


Figure 3.15 Budgeting techniques that respondents are familiar with

In Figure 3.15, the data displays the budgeting techniques that respondents are familiar with. 61.3% of respondents are familiar with the 50/30/20 rule, making it the most popular budgeting technique amongst respondents. 29% of respondents are familiar with the envelope method and the same number of respondents are familiar with automated savings. 3.2% of the respondents are acquainted with Zero-based budgeting however 12.8% of respondents do not know any of the listed budgeting techniques.

Section 4: Gaming Preferences and Feedback

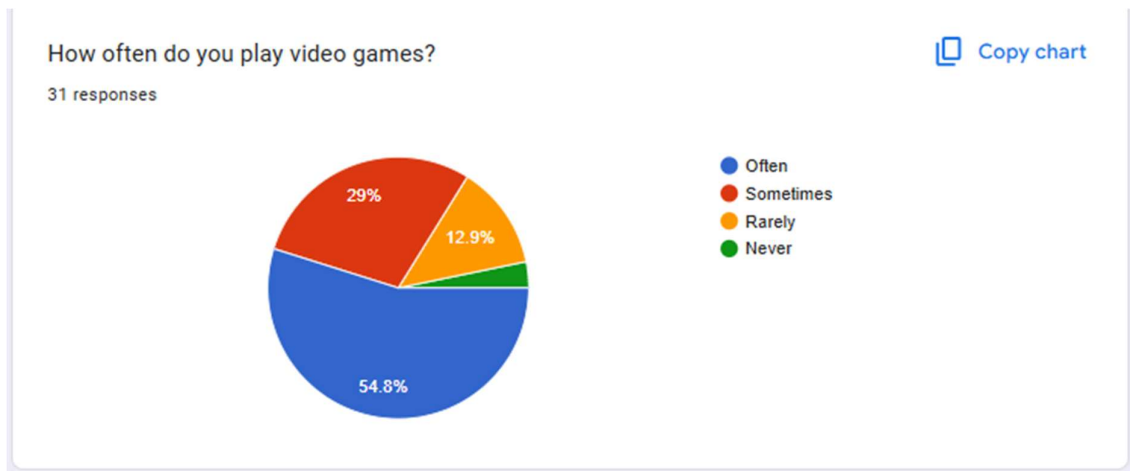


Figure 3.16 Respondents' gaming habits

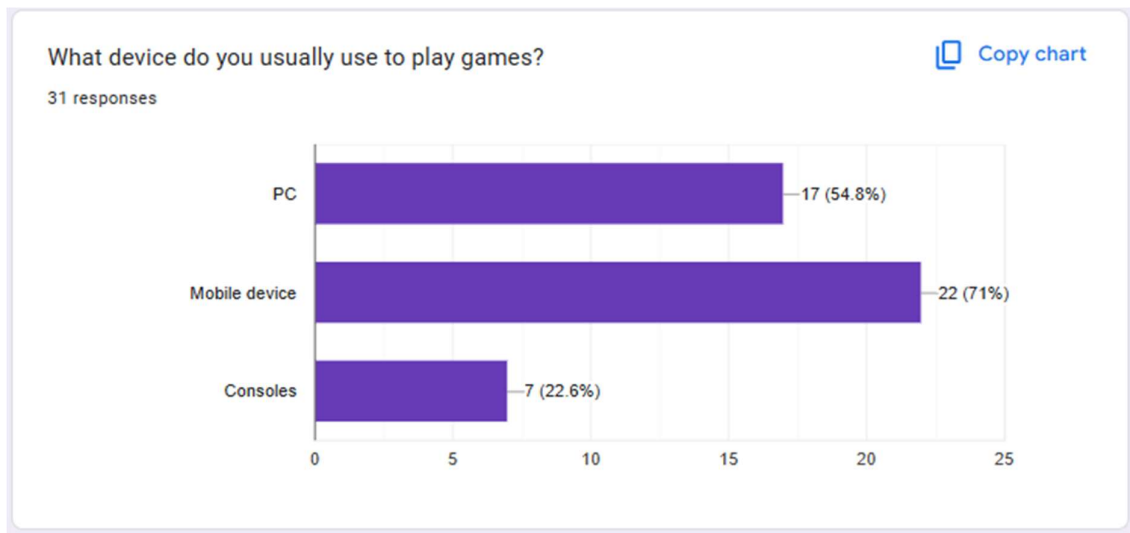


Figure 3.17 Respondents' preferred gaming device

According to Figure 3.16, over half of the respondents are avid gamers, with 54.8% of respondents reporting to often play games. 29% of respondents claim to sometimes play games whereas 12.9 % claim to rarely play games. Only 3.2% of respondents report to have never played games. In Figure 3.17, most respondents report to play games on their mobile devices, making up 71% of the respondents. Playing games on their PC is also a popular option, with 54.8% selecting the option. Only 22.6% of respondents usually play games on consoles.

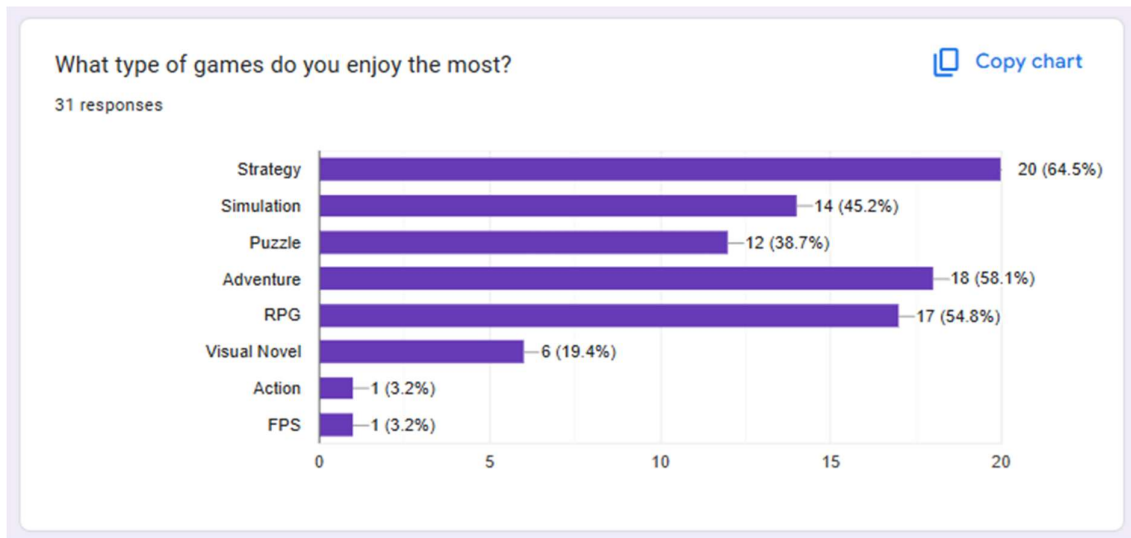


Figure 3.18 Respondents' preferred game genres

Figure 3.18 displays the most enjoyed game genres by the respondents. The top four game genres are strategy, adventure, RPG and simulation games. The answers from the respondents will help shape the game development.

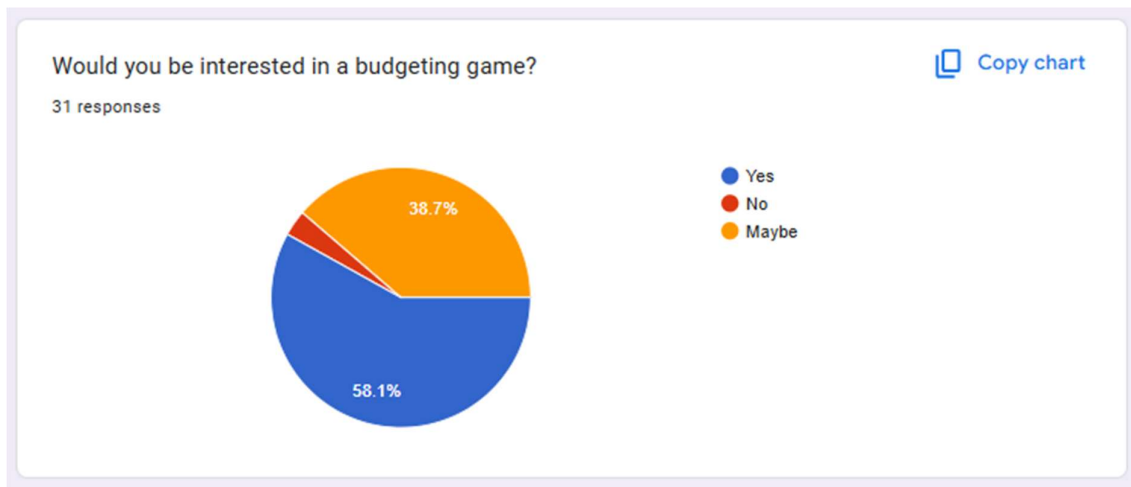


Figure 3.19 Respondents' interest in a budgeting game

When asked about the respondents' interest in a budgeting game, according to the data in Figure 3.19, 58.1% of respondents answered yes, and 38.7% of the respondents answered maybe. Only one person, making 3.2% of respondents, had answered no to this question.

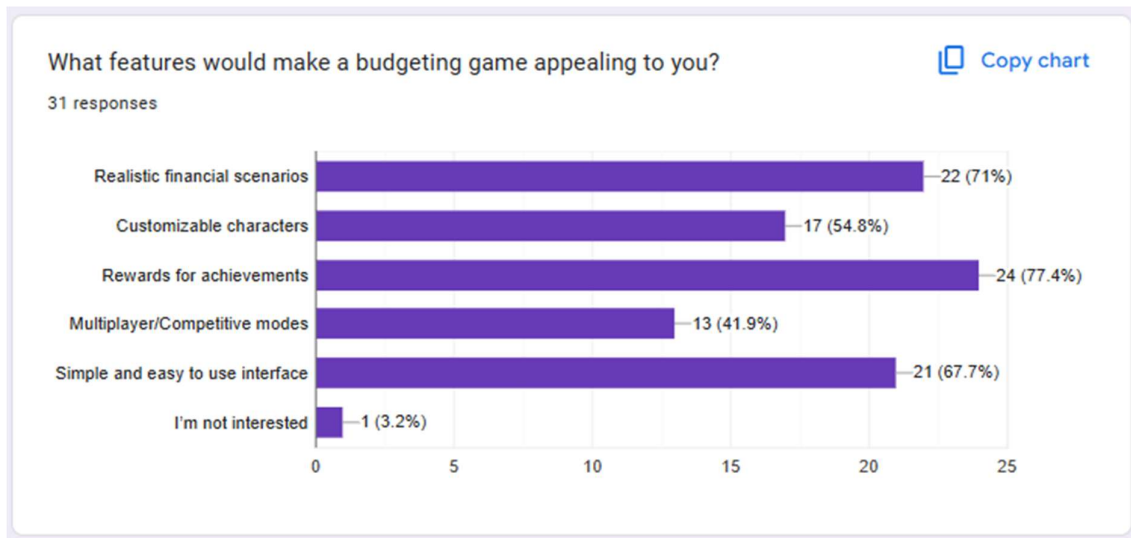


Figure 3.20 Respondents' preference on budgeting game features

In Figure 3.20, the top three features that would make a budgeting game appealing to the respondents are rewards for achievements (77.4%), realistic financial scenarios (71%), and simple and easy to use interface (67.7%).

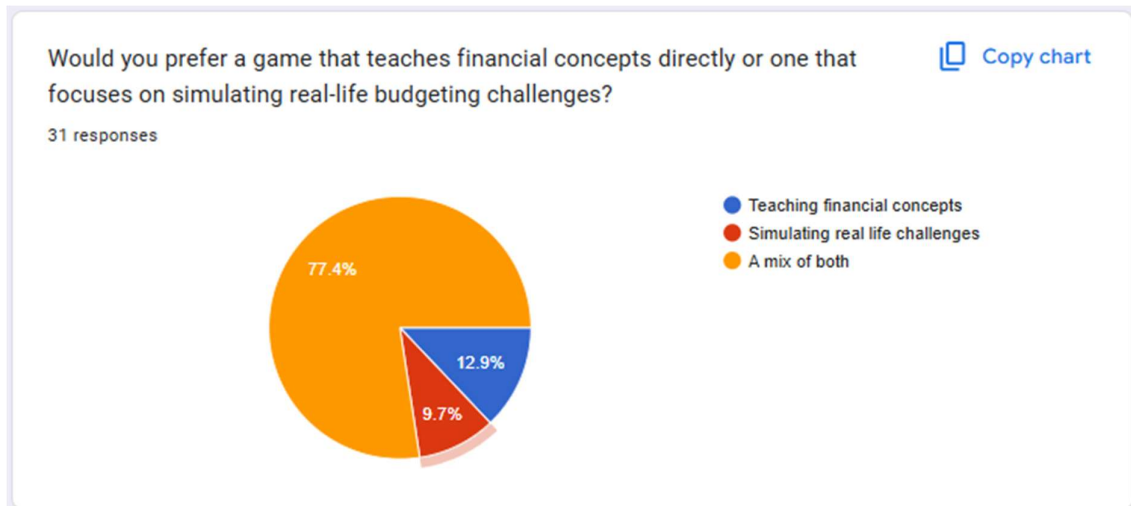


Figure 3.21 Respondents preference of game focus

The data in Figure 3.21 depicts 77.4% of respondents would prefer if the game had a mix of teaching financial concepts and simulation real-life challenges. Amongst the remaining respondents, more would prefer a focus on financial concepts (12.9%) compared to those who would prefer a simulation of real-life challenges (9.7%).

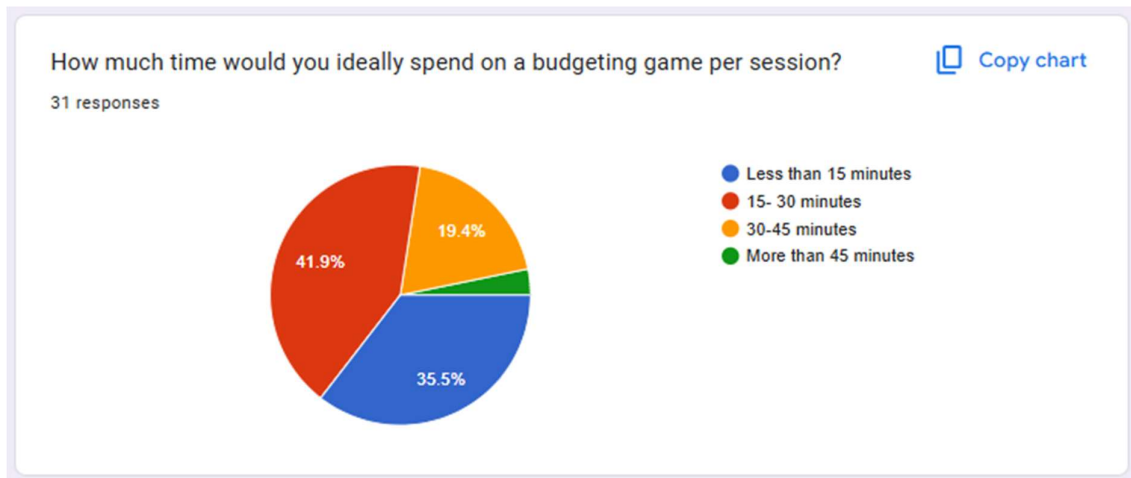


Figure 3.22 Respondents' preference of game length

According to Figure 3.22, most respondents would prefer if the game lasted 15 to 30 minutes per session, making up 41.9% of respondents. 35.5% of respondents would prefer if the game last 15 minutes at most, whereas 19.4% of respondents would ideally spend 30-45 minutes on the game. Only 3.2% of respondents would prefer if the game lasted more than 45 minutes per session. From this data, it is clear that a shorter game is preferred for a budgeting game.

The last question in the survey asks for suggestions for features and content that should be included in the game. Amongst the answers, few stood out, such as suggestions for the game to be a roguelike, having leaderboard and a board that would compile top game strategies for budgeting, skill upgrading features and a slot machine. Other suggestions call for simplicity and appealing visuals and music. These suggestions are valuable and will contribute to the game development.

3.3 Determine the LOs

Table 3.1 Course Learning Outcomes for EBU1063

CLO1	Prepare a smart money management plan
CLO2	Demonstrate good spending and saving habit
CLO3	Apply smart money management in retirement planning

Table 3.2 Course Content Outlines and the Learning Outcomes Associated

Course Content Outline	CLO
Understanding your relationship with money	CLO1, CLO2
Getting your finances in order	CLO1, CLO2
Making money and protecting your income	CLO1, CLO2, CLO3
Spending and saving	CLO2
Insurance	CLO1, CLO2
Debit and credit	CLO2, CLO3
Borrowing for big ticket items	CLO1, CLO2
Investment Basics	CLO2, CLO3
Investing for Retirement	CLO3
Financial Technology	CLO1, CLO2

The learning objectives (LOs) that are planned to be included in the game are based on the survey results as well as the course outlines used in EBU1063. EBU1063, Smart Money Management, is an elective course provided by the Faculty of Economics and Business in UNIMAS, aims to educate its students on money management. The course is equipped with information regarding the relationship between money and people, how to control finances, how to gain and protect income, spending and saving, debt and credit, insurance, basics of investments and planning for retirement. Table 3.1 displays the course learning outlines (CLO) and Table 3.2 displays the Course Content Outlines (CCOs). The CCOs are the topics taught in the elective course that supports the CLOs.

To determine the LOs of the game, it is crucial to tie the results of the survey with the CCOs in EBU1063. This is to ensure that the needs of the participants are fulfilled while adhering to tried-and-true methods and information. The results of the survey determine that the least understood financial topic is debt management, followed by saving strategies, followed by emergency funds and budgeting being in last place. However, although the respondents claim to have a better understanding of budgeting, many do not practice it, and when asked their biggest financial challenges, the top answer is sticking to a budget, followed by impulse spending and saving money. Upon comparing the CCOs of EBU1063 with the results of the survey, the LOs have been determined as shown in Table 3.3.

Table 3.3 Learning Outcomes for the Game

	Learning Outcome	Taxonomy Level
CLO1	Analyse cash flow statement	C4 Analyse
CLO2	Demonstrate good spending and saving habits	P3 Precision
CLO3	Define good credit and debt management practices	C1 Remember
CLO4	Develop budgeting plan	P4 Articulation

3.4 Determine Genre

This step of the methodology involves determining the genre of the game that will be developed. The genre of the game is selected based on the results of the survey conducted. When asked what genre of game they enjoy playing the most, the top genres are strategy, adventure and role-playing games (RPGs). Therefore, the genre of the game developed will be an educational strategy adventure RPG.

3.5 Write Premise

At this step, the game's premise is developed. The game tells the tale of a paladin and cleric who dream to enact revenge on a demon who had attacked their village, demanding the villagers' riches. As demon was unsatisfied with the villagers' wealth, it demanded a hostage be added to the list of demands. In order to quickly resolve the situation, the paladin's lover offered herself to the demon. The paladin and cleric only find out about the attack after returning from an adventure. However, as the belongings they had left in the village had been offered to the demons, they are forced to be smart in managing their finances to embark on this journey. In order to finance their adventure, they are forced to take a loan from a loan shark from a neighbouring town. With the loan, they are able to upgrade their equipment and hire other mercenaries to assist them in the journey. However, throughout the journey, they must be able to gain and save enough money to pay off their debt while paying off their necessities. While killing monsters is profitable, they also do odd jobs in the towns they visit on the way to kill the demon. With every location visited, the pair of adventurers will track their income and expenses, creating a cash flow statement. The game ends when the player is successful in killing the demon (true ending) or is unable to pay off the loan (bad ending).

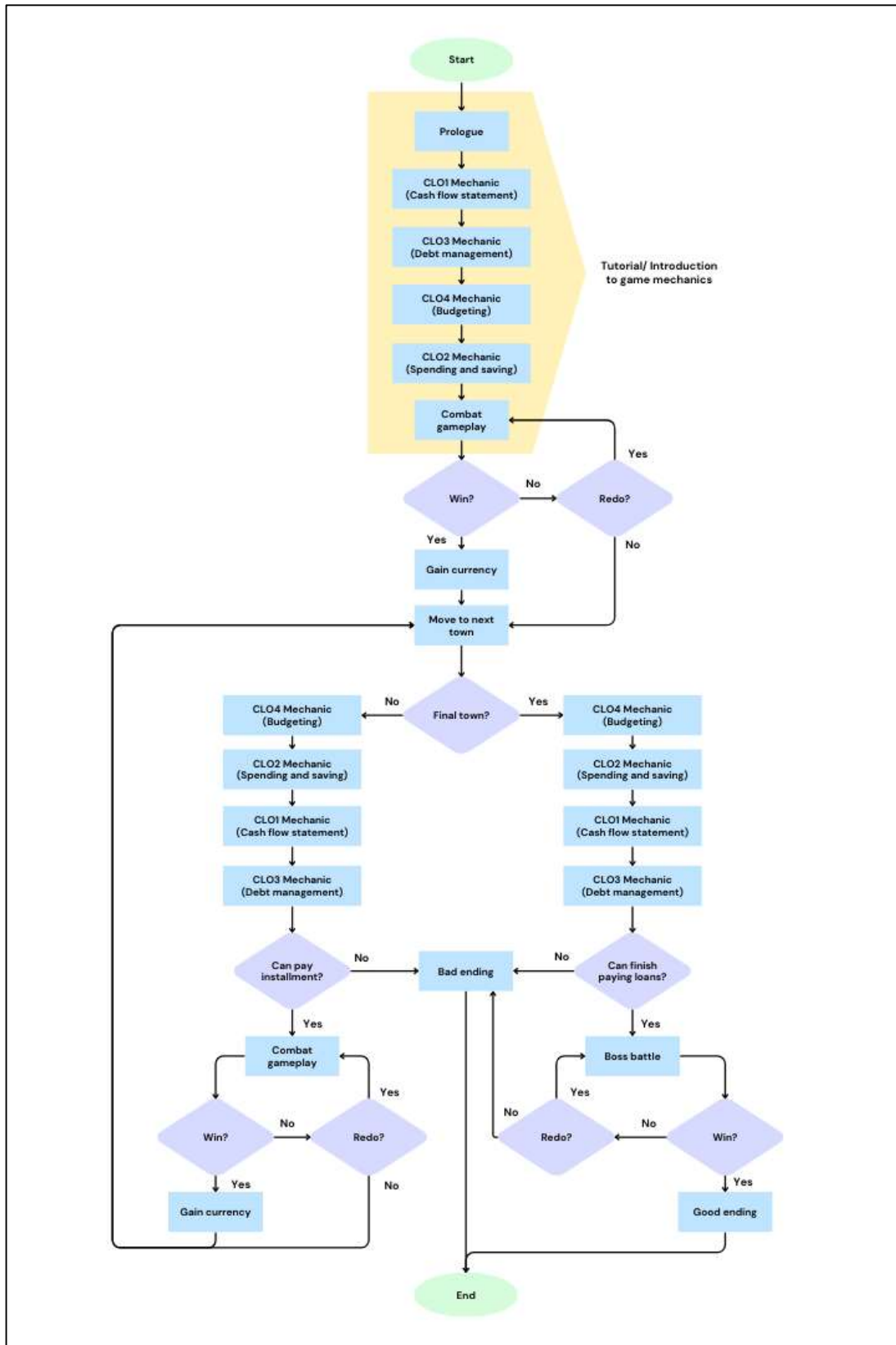


Figure 3.23 Flowchart of the game's progression

3.6 Design LO Mechanic

In this step, the LO mechanics used in the game will be designed. The LO included in the game are determined based on the course content outlines of EBU1063 (Smart Money Management) and the results of the survey. The LO mechanics aim to help the players achieve the LOs by progressing through the game.

The overall design of the game is depicted through the activity diagram in Figure 3.24, use case diagram in Figure 3.25 and use case descriptions in Table 3.4, Table 3.5 and Table 3.6. The Sequence diagram is depicted in Figure 3.26 and the class diagram in Figure 3.27.

The first diagram depicted in the activity diagram in Figure 3.24. An activity diagram displays the actions that can be taken within a system or process and the sequence it is done in. The activity diagram below shows the sequence of actions in the proposed game I <3 Money. Upon loading the game, the player will view the game's title screen, where they are presented with three options, "Start Game", "Settings" and "View Credits". The activity diagram does not have an end, as the game is a web-based game, and once finishing the game, they are led back to the title screen. If they do not wish to play the game, they can simply close the tab.

If the player selects the "Start Game" option, the main I <3 Money gameplay will start. The player will read through the prologue of the game to understand the motivation of the main character. The story and tutorial will be relayed through dialogue boxes. After going through the story, the player will then go through the LO mechanics, which will evaluate the player based on their ability to plan their expenses and stick to the budget they set. After the player buys the items and upgrades for their characters, their characters will then battle with monsters to gain money and to move on to the next town, where they will go through the LO mechanics once more and then fight another battle. This gameplay will loop until the player reaches the demons castle. Upon completing the main goal of the game, which is to defeat the demon, the game will be finished, and they will be redirected to the title screen.

Selecting the "Settings" option will allow the player to adjust the volume of the game as well as the text speed of the dialogue boxes. The player will then have the option to save the settings or exit the settings screen, both options will ultimately lead the player back to the title screen. Selecting the "View Credits" option will allow the player to read through the contributors and their contributions to the game.

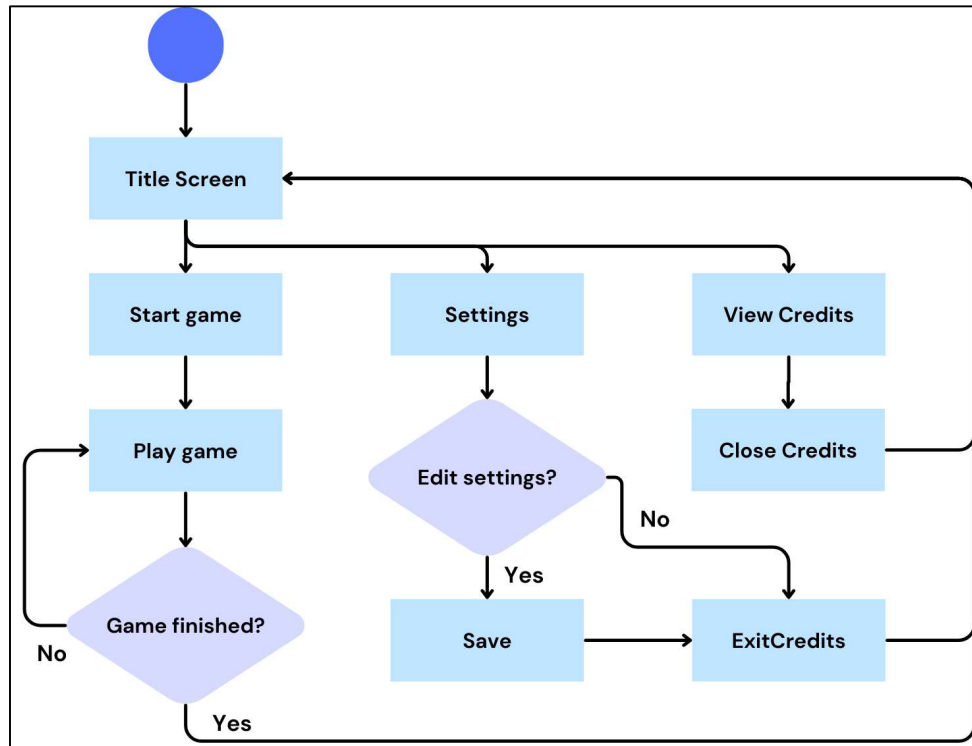


Figure 3.24 Activity Diagram

Figure 3.25 depicts the use case diagram for I <3 Money's game system, whereas the description for each use case is depicted in Table 3.4, Table 3.5, and Table 3.6

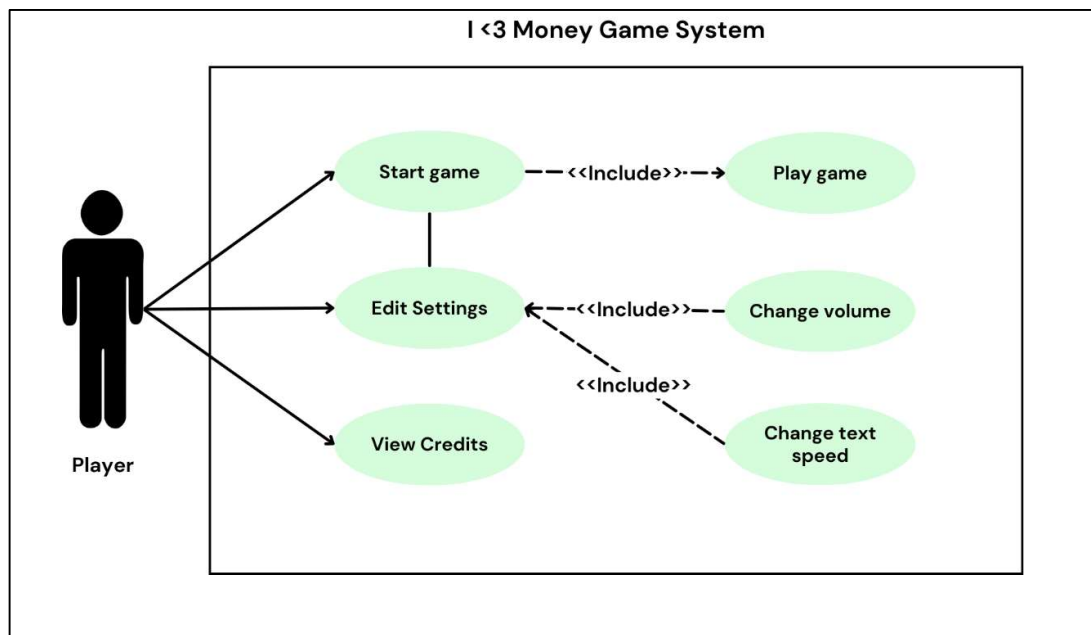


Figure 3.25 Use Case Diagram for I <3 Money Game System

Table 3.4 Use Case Description for Start Game

Use Case Name	Start Game
Short Description	The player starts a new game
Actor	Player
Pre-Condition	None
Post Condition	The player is able to play the game
Main Flow	The player selects the Start Game option on the title screen
Alternative Flow	None
Exception Flow	None

Table 3.5 Use Case Description for Edit Settings

Use Case Name	Edit Settings
Short Description	The player edits the settings of the game
Actor	Player
Pre-Condition	None
Post Condition	The players settings are edited
Main Flow	1. The player selects the Edit Settings button to view the settings screen 2. Player changes the sound and music volume 3. Player selects the save settings button 4. Player leaves the settings menu
Alternative Flow	At step 2, the player changes the text speed
Exception Flow	None

Table 3.6 Use Case Description for View Credits

Use Case Name	View credits
Short Description	The player views the credits to the game
Actor	Player
Pre-Condition	None
Post Condition	The player can view the credits
Main Flow	The player selects the View Credits option on the title screen
Alternative Flow	None
Exception Flow	None

Figure 3.26 displays the sequence diagram for the game. A sequence diagram is used to depict the process interactions in a time sequence. It shows the processes and objects involved and the sequence of messages exchanged to perform the functionality requested.

When the player loads the game, the title screen will load. From there the player can select different buttons, which will allow them to either start a new game, view credits, or edit the settings. If they choose to start a new game, the game screen create a new game file, and load the prologue of the game. The player will then be able to start playing the game.

Upon selecting to view credits, the game will load the credits of the game and then display it on the game screen. The player can view the list of contributors before going back to the title screen.

If the player selects the settings button, the player will be able to edit the settings of the game. The settings that are available to be changed will be the overall game volume and the text speed of the dialogue boxes in the game. The player can then save their edits to the settings before returning to the title screen.

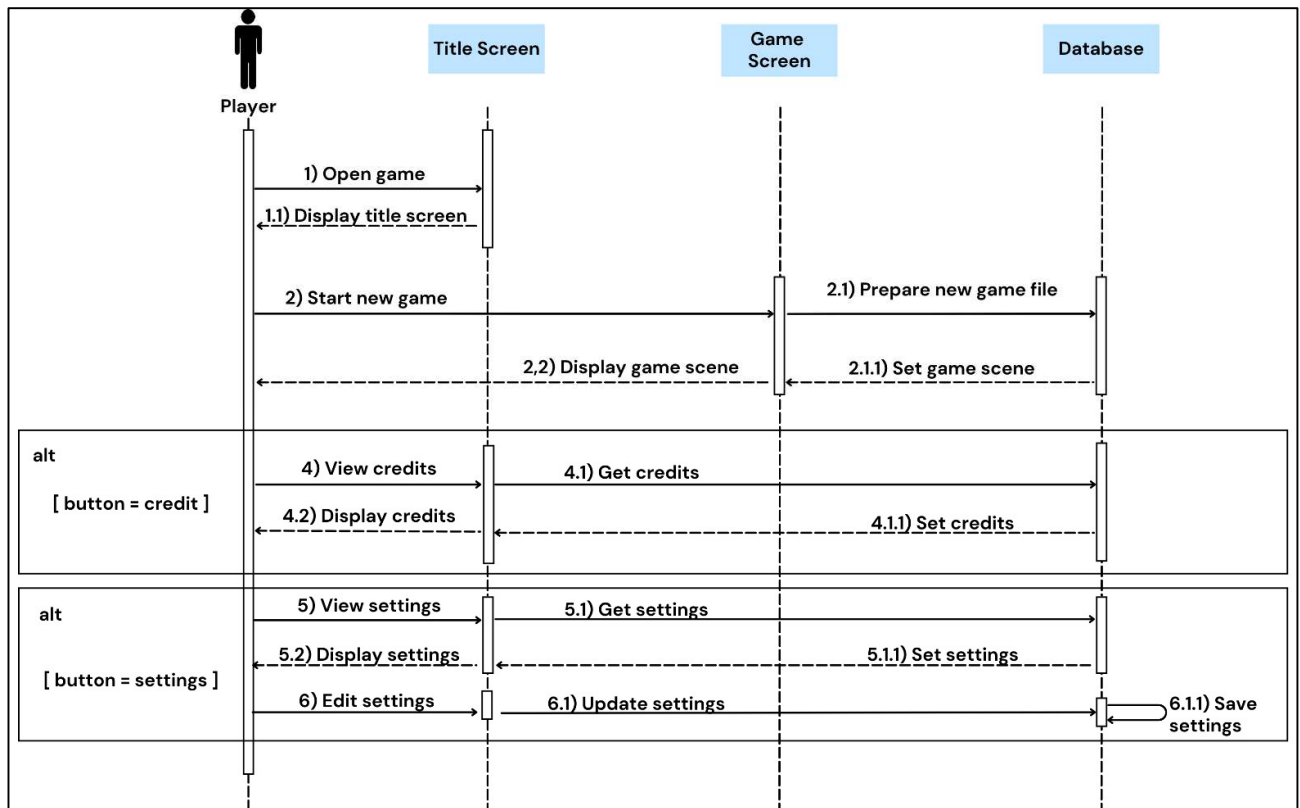


Figure 3.26 Sequence Diagram

Figure 3.27 displays the class diagram for the game. A class diagram depicts the systems structure by displaying the relationships between objects, the classes involved and their attributes.

The game allows the player to view, edit the settings and play the game. If the player chooses to start playing the game, the game's story will begin. From there, the gameplay class will keep track of the money the player has and the debt they have accrued. The town class keeps track of the player's progress through the game. Each town has certain jobs that the player can do to increase their money, items and upgrades that can be bought, as well as mercenaries that can be hired to assist the main characters on their journey. The items bought as well as the equipment upgraded will be stored in the inventory class.

In between towns, the player will fight monsters on the way, which will earn them money. This is done by utilizing the characters that they own, each with their own skills. The gameplay of the fighting portion will be turn-based, so after all of the characters have had their turn to attack, the enemy will then attack the player's characters. The character class stores the health points of the character as well as the players normal attack damage. Each character also has

their own special skill that has different effects. The enemy class stores the enemy’s health points and attack damage. Upon depleting the enemy’s health points, the player will win the fight and move on to the next town.

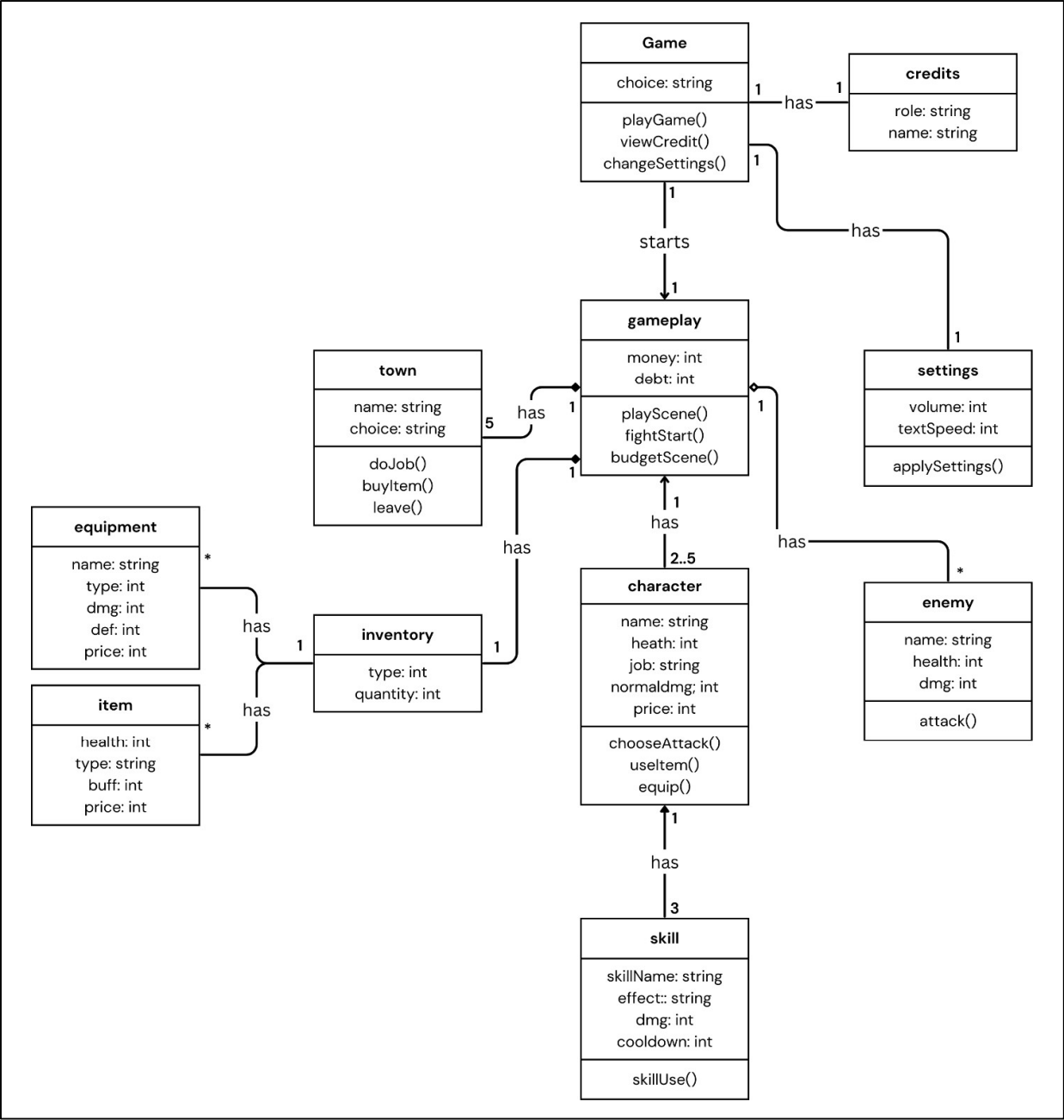


Figure 3.27 Class Diagram

The first LO is for the player to be able to create and analyse a cash flow statement. The mechanic designed for this LO (refer Figure 3.28) is a set of questions to evaluate the pair of

main characters past expenses and their income. In this mechanic, one of the main characters will read out the expense made or the income gained and its details, and the player will choose whether the expense is an expense made in need or wants, or an income. The correct answer to these questions are based on the decision tree in Figure 3.29.

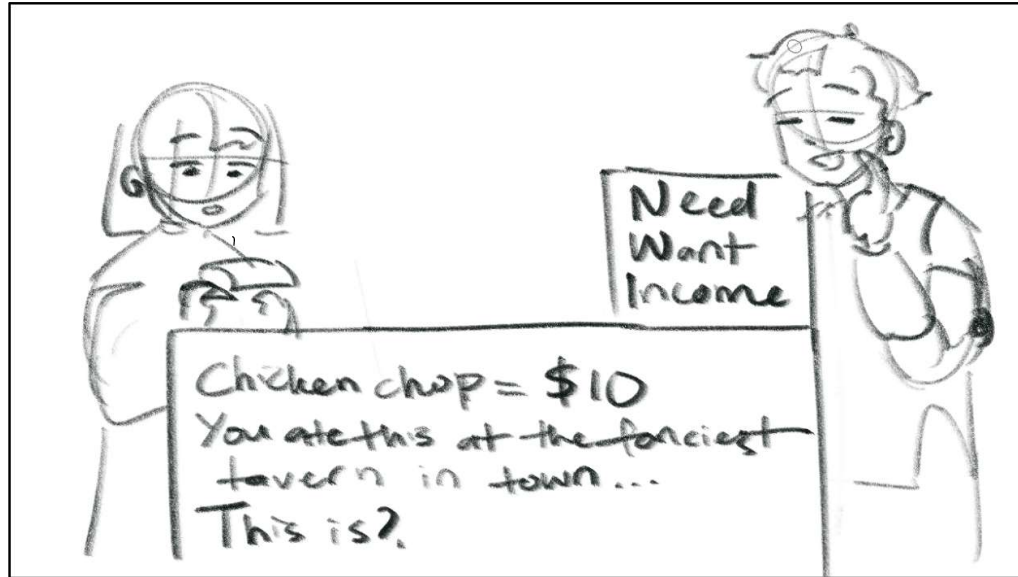


Figure 3.28 Sketch of game mechanic for LO1

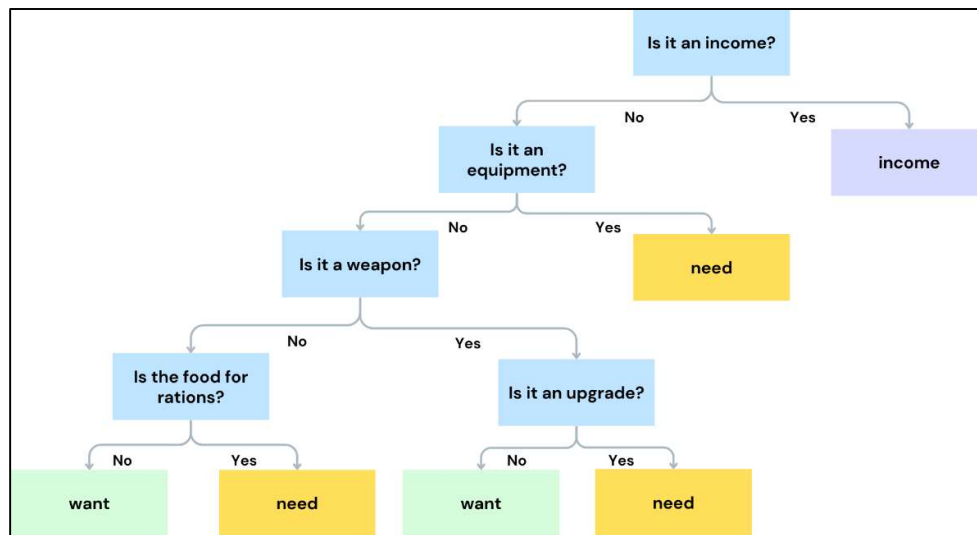


Figure 3.29 Decision tree for LO1 game mechanic

For LO2 and LO4, which is to understand good spending and saving habits and to be able to develop a budgeting plan respectively, the player will develop a budgeting plan to determine how much money they will spend during their stay at a town they visit. For this mechanic, the player is able to determine how much money they will spend for specific

categories, with non-negotiable expenses, such as salaries of the mercenaries hired, already deducted from their balance. Figure 3.30 displays the sketch of the planned budgeting screen.

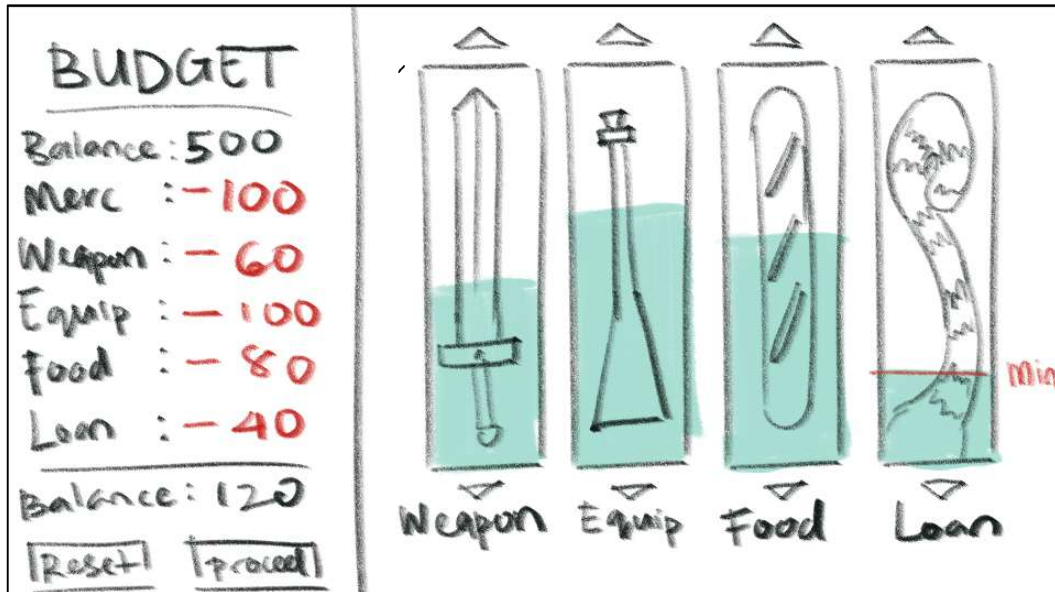


Figure 3.30 Sketch of planned budgeting screen for LO2 and LO4 mechanic

After developing the budgeting plan, only then they are able to go into the city and spend their money, entering stores and taverns in order to buy food, equipment, weapons or hire mercenaries. Figure 3.31 displays a sketch of the store selection screen and Figure 3.32 displays the sketch of the options available when entering a tavern. Figure 3.33 presents the sketch of mercenary hiring screen available in a tavern. However, it is up to the player to stick to the budget allocated, and they are free to use the money the way they see fit. Upon exiting the town, a cash flow statement will be generated, comparing the expenses to the budget made for the city, and scoring the player based on how well they stuck to the budget. This is shown in Figure 3.34.



Figure 3.31 Sketch of planned store selection screen



Figure 3.32 Sketch of planned options available in stores

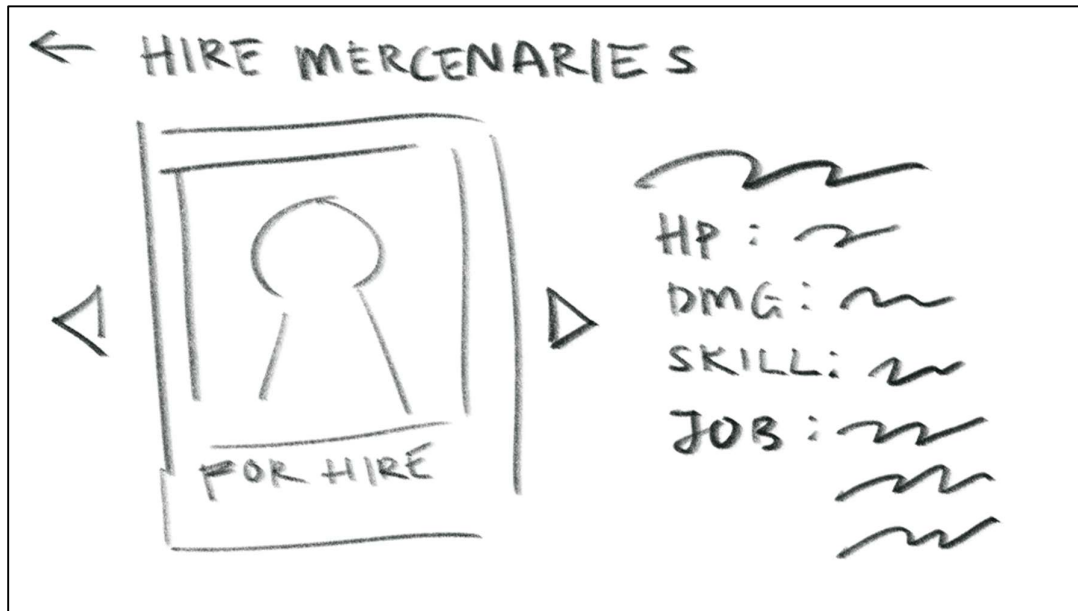


Figure 3.33 Sketch of the mercenary hiring screen

Category	Budget	Actual	Score
Mercenary	100	100	-
Weapon	60	80	☆☆☆
Equip	100	60	☆☆☆☆☆
Food	80	80	☆☆☆☆☆
Loan	40	80	☆☆☆☆☆
Total	380	400	☆☆☆☆

BALANCE = 100

PROCEED

Figure 3.34 sketch of automated cash flow statement and score screen

For the LO3 mechanic, which is to manage debt, the main characters choose to borrow from a loan shark and discuss about the consequences of that choice. In the dialogue, the main characters will talk about interest and strategies to pay off the debt. In Figure 3.30, the player is able to choose the amount of money they will allocate into paying off the loan they made. However, there is a minimum payment set that must be paid, the player is able to choose to

allocate more than the minimum payment, but not less than that. Before the player is able to move to the next city, the loan shark will appear to collect the money, and being unable to pay the minimum payment will result in the bad end screen, depicted in Figure 3.35.



Figure 3.35 Sketch of bad ending screen

3.7 Design Related Elements

This step of the methodology involves designing elements related to the game. Another mechanic is added to the game, which is a turn-based combat mechanic. The combat mechanic is added as a means of motivation for the player to spend, necessitating the purchase of equipment and items to ease their fights. The combat mechanic also serves as a source of income for the player, rewarding the player after a successful battle. Figure 3.32 shows the sketch of the combat mechanic.

In the combat screen, the characters and the enemy's health points (HP) will be displayed below their avatars. Each characters have a turn to do an action before the enemy(s) are able to attack. There are four types of actions, which are Attack, Use, Skill and Skip. Attack will have the character do a basic attack onto the enemy. Use allows the characters to use one of the equipment they have in their inventory. Skill allows the character use a special move, which will have a special effect, however each special move has a cooldown. The character will not do anything for their turn if Skip is selected.

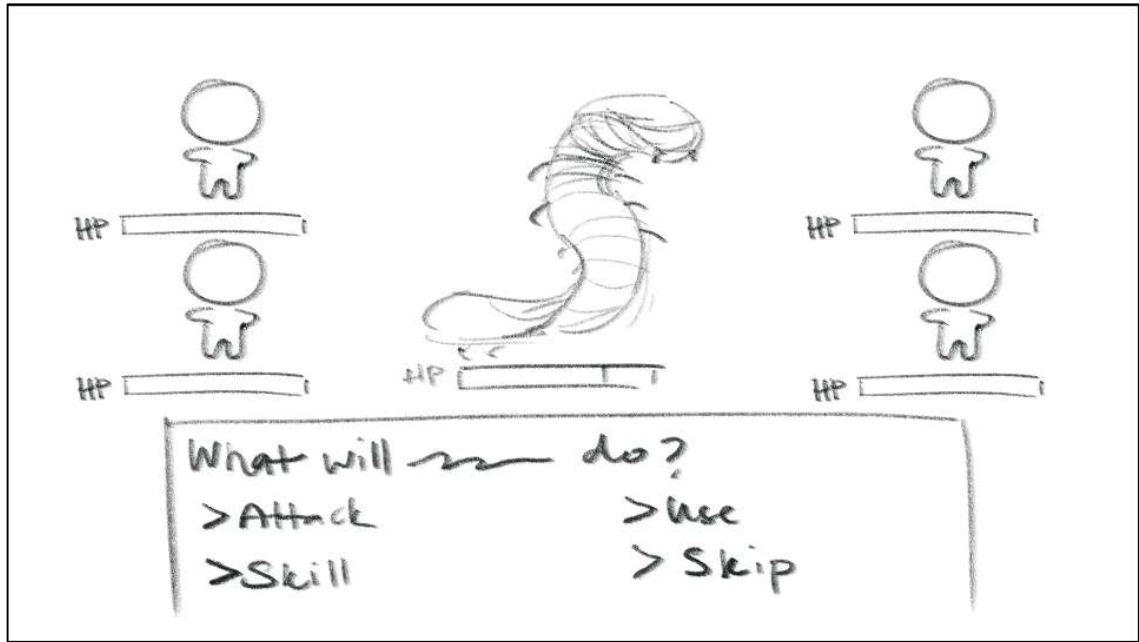


Figure 3.36 Sketch of planned combat mechanic

3.8 Integrate the Previously Designed Mechanics

This step and the following steps will be implemented in Chapter Four of this article. In this step, each mechanic will be developed separately. As the gameplay implements the mechanic multiple times throughout the game with variation in values, the mechanic will be developed first and then reused.

3.9 Playtest and Evaluate the Mechanic

Playtesting of individual mechanics will be done by friends and family to evaluate their reception of the game and to gain suggestions from them to improve the mechanic.

3.10 Integrate all Elements

Upon the completion of all gameplay mechanics, the levels will be combined along with the narrative portion of the game to create a complete game.

3.11 Playtest and Evaluate the Game as a Whole

The respondents of the survey who agree to being contacted to playtest the game will be contacted to evaluate the game and its effectiveness. The evaluation of the financial knowledge imparted will be done through a pre-test and a post-test.

3.12 Summary

This chapter explains the methodology used in the project, as well the steps involved to determine the projects requirements and its design. Four LOs are determined based on a survey conducted and course content outlines of EBU1063. Then, the premise of the game is developed along with the design of the LO mechanics. After the design of the LO mechanics, related elements and additional mechanics are designed. The rest of the methodology's steps, which are integrating the previously designed mechanics, playtesting and evaluating the mechanics, integrating all elements, and playtesting and evaluating the full game will be carried out in the future chapters.

CHAPTER 4: IMPLEMENTATION

4.1 Introduction

This chapter details the sixth and eighth steps of the outcome-based methodology. The seventh step is skipped in this chapter and will be discussed in chapter five as it requires testing. The sixth and eighth step are:

- 1) Integrate previous mechanics
- 2) Integrate all elements

After the first mechanic has been designed and refined, the mechanic is then developed into a working prototype. Once the work on the first mechanic is done, the next mechanic will then be refined and developed, as will the mechanic that comes after the second. All visual assets seen in the game are created by Huda Nadhirah binti Saiful Bahtiar, except for the enemy assets used in-game, which were designed by Muhammad Isyraf Imran bin Saiful Bahtiar, and then refined by Huda Nadhirah binti Saiful Bahtiar. The audio assets in the game were acquired for free on itch.io. The development of the mechanics and the game itself was done using Godot Engine and written in GDScript using the built-in development environment.

The final game, I <3 Money, has a few differences compared to the drafts shown in Chapter 3. One of the key adjustments is made to the LO4 (Budgeting) mechanic, as there will be no screen to set the budget as outlined in Chapter 3. Instead, the game is difficult to win if the player does not actively plan their spending and will result in a game over if the player is unable to pay their debt or do not have enough food. Another key difference is in the combat system, where instead of being a currency collecting mechanic with no LO, the player will be quizzed on financial topics regarding budgeting and debt, making it a game mechanic that covers all four LOs. The combat system has another amendment; the mercenary system has been replaced with skills that can be bought and upgraded. Other than that, the overall UI of the game has been updated, but do not affect the LO mechanics.

4.2 Integrate Previous Mechanics

The game has four LOs that it aims to accomplish through gameplay mechanics, as discussed in Chapter 3. The contents of the game are shown below

4.2.1 In-Game UI

As seen in Figure 4.1, the game's UI is split into three sections, the display screen, the text box, and the side menu. The display screen is located on the top left of the game, and is used to show the characters during the story portions of the game, and during combat, it displays the type of enemy and their health points. When the player arrives at a city, the display screen is interactable, allowing users to enter the store and buy food, upgrade or buy skills and take on jobs. More about this mechanic can be found in subchapter 4.2.3.

The text box is placed on the lower left of the game's window, and will display the character's dialogue during story or tutorial portions of the game, as well as display the actions taken by the characters and enemies during combat gameplay. The textbox is also used to show questions and the answer options, which will be discussed further in subchapter 4.2.4.

The side menu is on the right of the game screen and has four menus that can be accessed upon progressing through the story. The first menu is the Resources and Expenditure menu, shown in Figure 4.1, which can be accessed by clicking on the button with a coin icon. This menu presents the player's balance, how much food they have, the amount of money they need to pay for their loans, as well as their income and expenses.

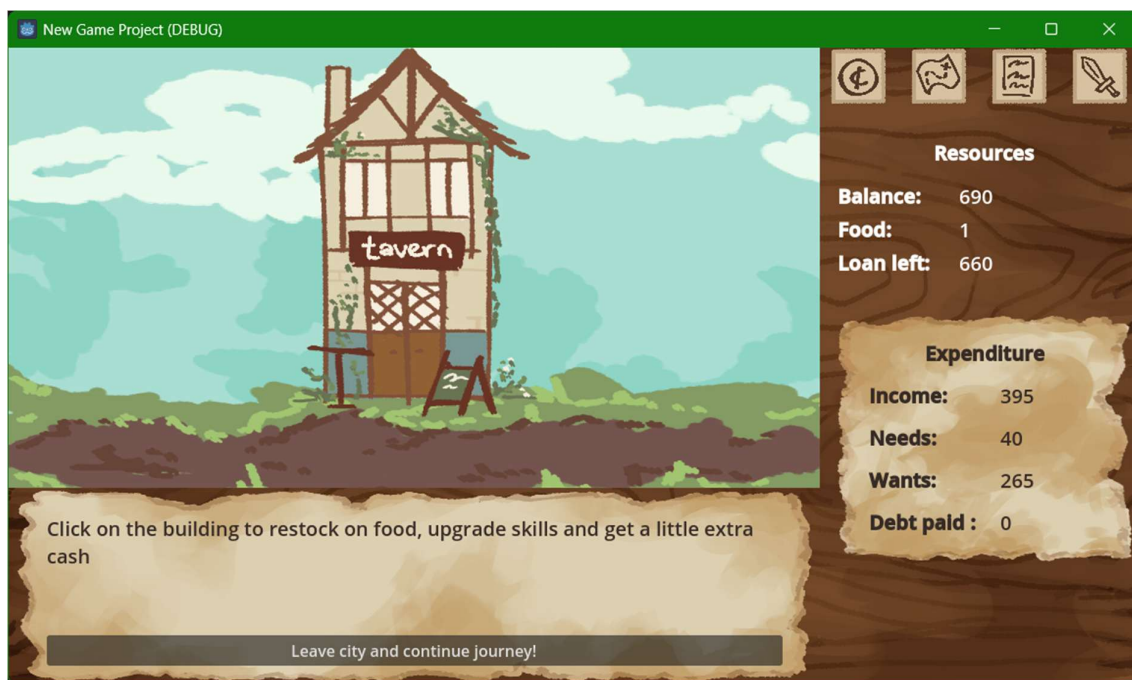


Figure 4.1 In-game screen with Resources and Expenditure Menu Open

Upon clicking the button with a map icon, the player is shown a map that displays how long it will take to reach to the end of the game. The red dots signify the number of in-game

days, whereas the green dots signify the days that have already passed. Every in-game day that the player goes through will consume one unit of food, therefore the map is included in the game so the player can know the minimum amount of food they need to have to ensure they can reach the next city. The map also helps players anticipate when the game might end, to avoid being overwhelmed.

In Figure 4.3, the screen for the Notes menu is shown. The Notes menu is unlocked during the end of the first story portion in the game, and can be accessed through the button with the icon of paper with writing on it. The Notes menu displays short explanations of financial concepts that are crucial to budgeting and questions regarding them will be asked during combat. The contents of the Notes menu will be included in Appendix D.



Figure 4.2 Map Menu

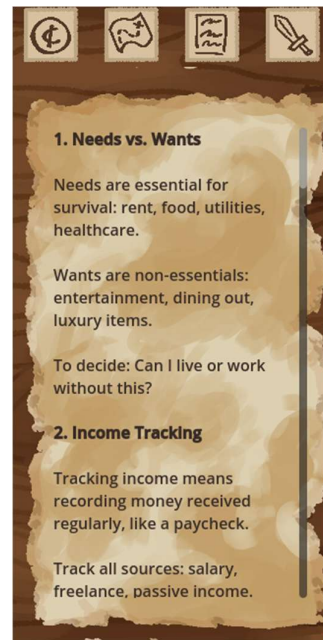


Figure 4.3 Notes Menu

The combat menu is displayed in Figure 4.4, and is unlocked upon entering the first fight scene in the game and can be accessed by clicking on the button with a sword icon. On the top of the menu, the number of Skill Points (SP) possessed by the player is displayed. Certain actions require SP, and cannot be used without sufficient SP.

Below the SP counter are two combat action panels, each corresponding to the playable characters in game, and are signified by the half portrait of the characters on the left side of the panel. During combat scenes, the player will select an action from the dropdown menu, and the

text below the dropdown menu will explain the action selected. This allows the player to make informed decisions before choosing an attack. At the bottom of the combat action panels are the respective character's health bar.

Below the combat action panels are two buttons, Fight and Run. These buttons are only enabled during combat. When the Fight button is clicked, the actions selected in the combat action panels are executed. On the other hand, if the Run button is clicked, the player is informed they have run from the battle, and will exit the combat scene.

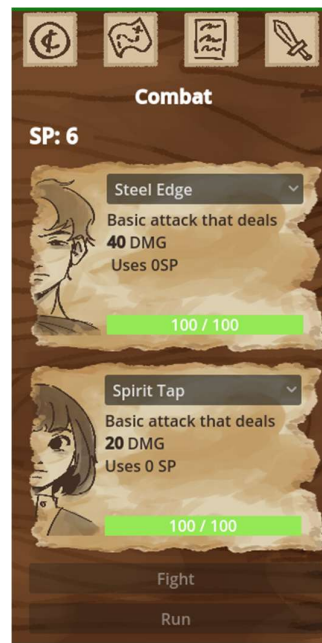


Figure 4.4 Combat Menu

4.2.2 LO1 Mechanic (Analyse Cash Flow Statement)

For the first LO mechanic, the characters in the game, Claire and Brock, discuss about their finances. Upon unlocking the Resources and Expenditure menu, Claire explains the difference between wants and needs and income. As shown in Figure 4.5, Claire will read out a receipt or invoice and the player is then prompted to identify if the item is a want, need or an income. If the player selects the right button, Claire will move on with the next item, which is displayed in Figure 4.6. If the player selects the wrong button, a sound will play, and Claire will give an explanation to the player and prompt the player to try again (refer to Figure 4.7).

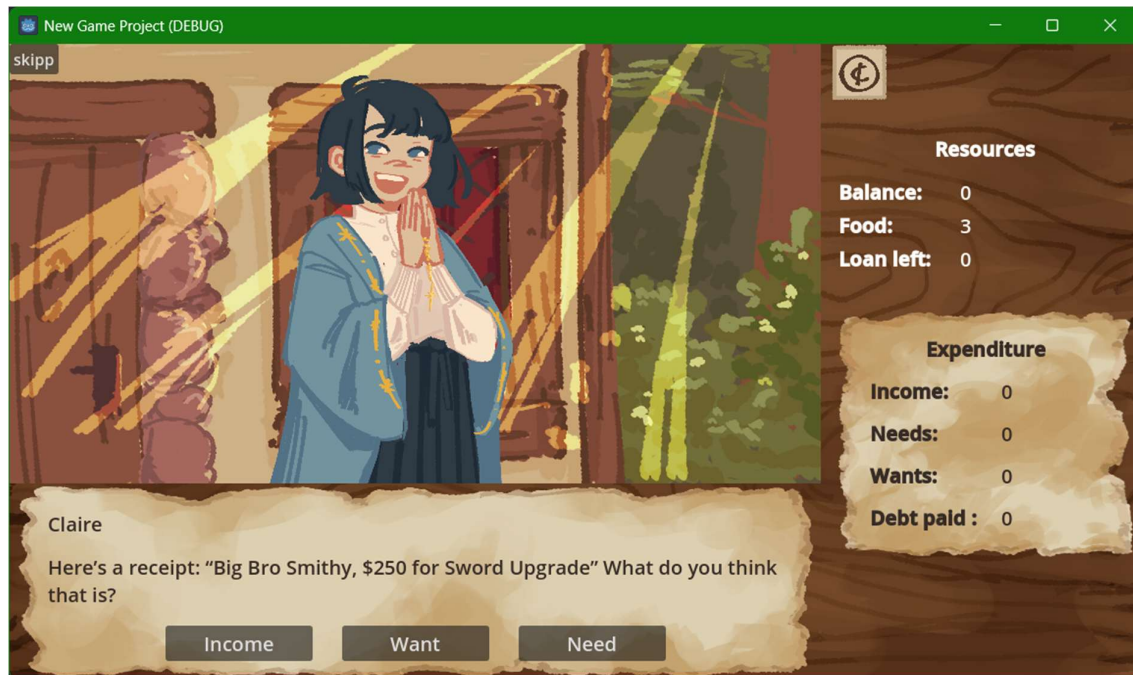


Figure 4.5 LO1 Mechanic Question

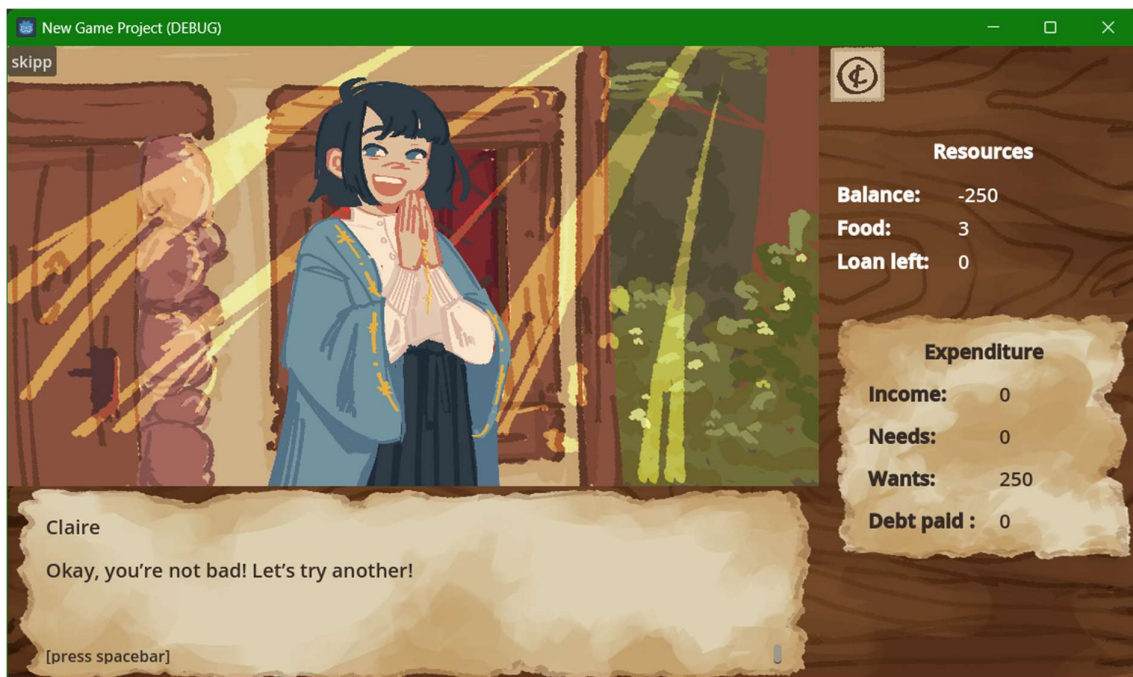


Figure 4.6 Claire Response when Clicking Correct Answer

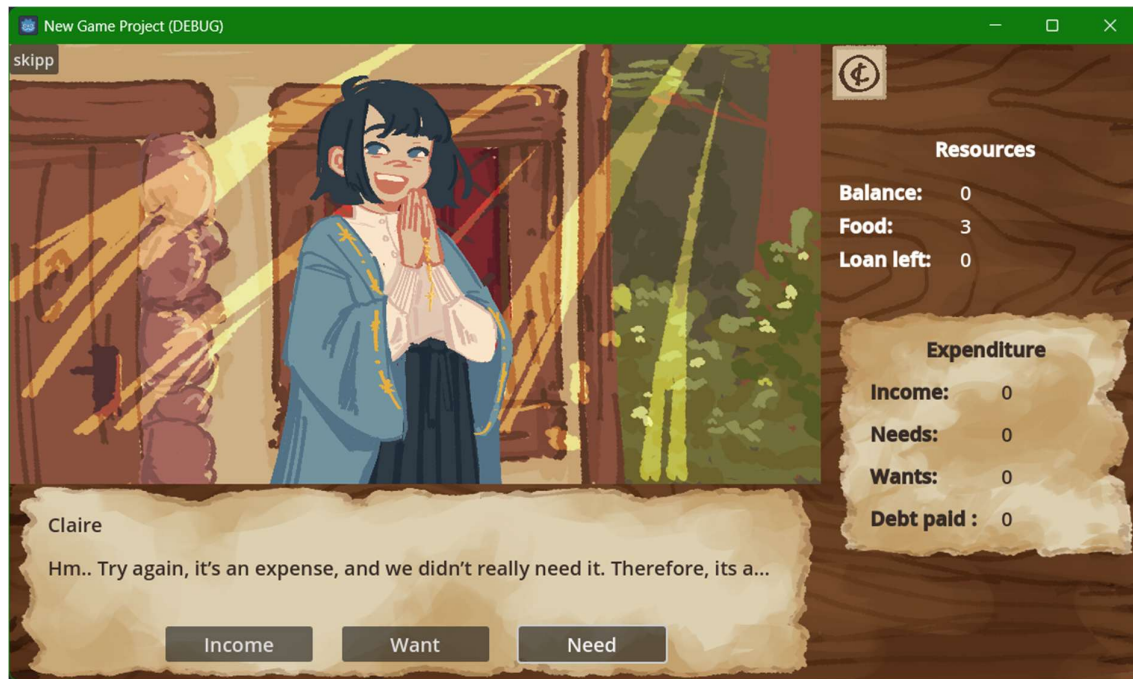


Figure 4.7 Correction when Clicking Wrong Answer

4.2.3 LO2 Mechanic (Spending and Saving)

The game encourages good spending and saving practices by requiring the player to pay back debt while also buying necessities to continue the game (food), and also upgrading and learning new skills to speed up battles. As battles and the currency gained from the battles are both randomised, gaining currency can either be very easy or difficult, or both at different phases of the game. Players will find that they should pay back the debt as soon as possible or ensure that they have bought food first before buying skills, which is a budgeting technique (paying or putting away money for needs first). Figure 4.8 displays the food buying screen.



Figure 4.8 Food Buying Screen

Alongside buying food and paying debt, the player can buy and upgrade skills on the skill buying screen that is only accessible when visiting a city. As the prices of the skills are usually higher than the currency gained from fighting enemies, the player will have to think carefully before buying any skills to ensure they still have money for paying the loan made at the start of the game. Figure 4.9 displays the screen where the players can buy skills and upgrades



Figure 4.9 Buying Skill Screen

4.2.4 LO4 Mechanic (Credit and Debt Management)

In the story, Claire and Brock take out a short-term loan with the Loan Shark. The dialogue touches very briefly on the basic concept of debt. The player is told the loan's interest will increase with every city they enter, therefore it is recommended to pay off the loan as soon as possible. When the player is about to leave the city, the player needs to pay the Loan Shark at least 100c to proceed, as shown in Figure 4.10. If the player is unable to pay the Loan Shark, the game will end. The scene before the game ends is shown in Figure 4.11.



Figure 4.10 Loan Shark demanding payment



Figure 4.11 Scene before the game ends due to not paying debt

Other than the loan mechanism, the combat mechanics also play a part in teaching about good debt practices.

4.2.5 Combat Mechanic (LO2, LO3, LO4 Mechanic)

The combat game mechanic in I <3 Money takes the structure of turn-based strategy games and implements a quiz on financial concepts. In the story, the characters receive a personal finance book. The contents of the book are accessible from the side menu and also hold the answers to the questions that are asked during combat. Figure 4.12 displays the dialogue used in the tutorial that prompts the user to look at the notes before continuing battle.

As shown in Figure 4.13, after the characters attack the enemy, a multiple-choice question will appear along with a timer. The topics covered in the questions are the same as what is covered in the Notes menu, which are budgeting practices and good debt management. Answering the question correctly and within 5 seconds will allow the character to receive the most minimal damage, sometimes not receiving any damage at all. If the answer is correct but it takes more than 5 seconds, the player receives a bit more damage compared to if they answered quicker. If the player chooses the wrong answer, the character will receive more damage, and if they do not answer at all, the character will receive the max amount of damage the enemy can deliver. When the enemy dies, the player will receive currency based on the difficulty of the enemy (refer to Figure 4.14).



Figure 4.12 Prompt to make player read notes before battle



Figure 4.13 Quiz portion of combat mechanic

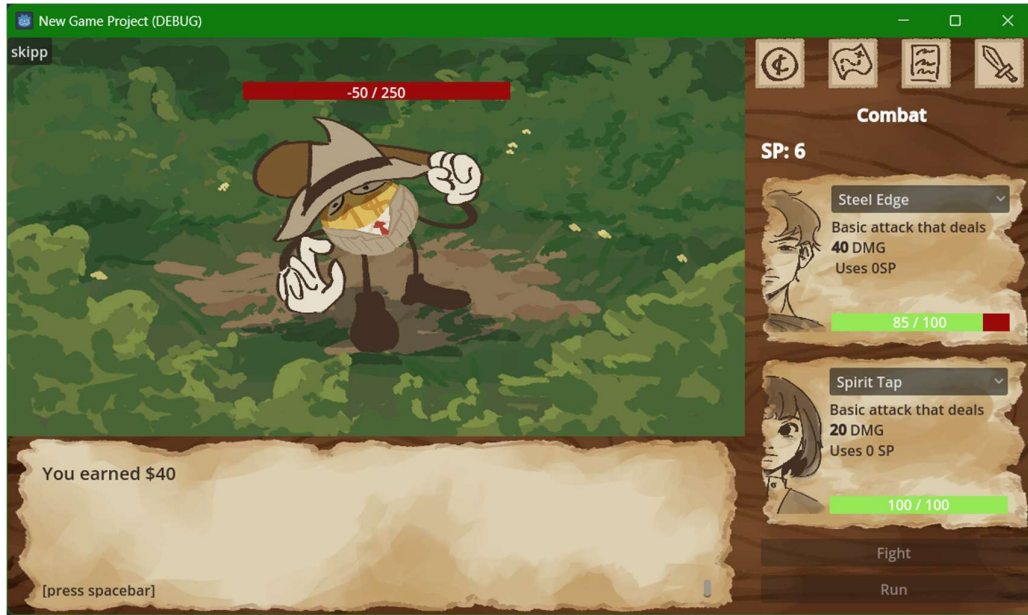


Figure 4.14 Player receiving money after defeating enemy

At the end of the journey, the player will fight a boss battle. This battle employs the turn-based strategy gameplay, however, the player is no longer quizzed on financial concepts. Instead, the boss battle is implemented to test whether the player has made sufficient upgrades to be able to survive and defeat the boss. If the player fails to fight the boss the game ends, and the player will have to replay the whole game. However, if the player wins, they get a sum of currency (refer to Figure 4.15) and get to meet Brock's lover, Luna as well as learn the about the background of the Loan Shark.

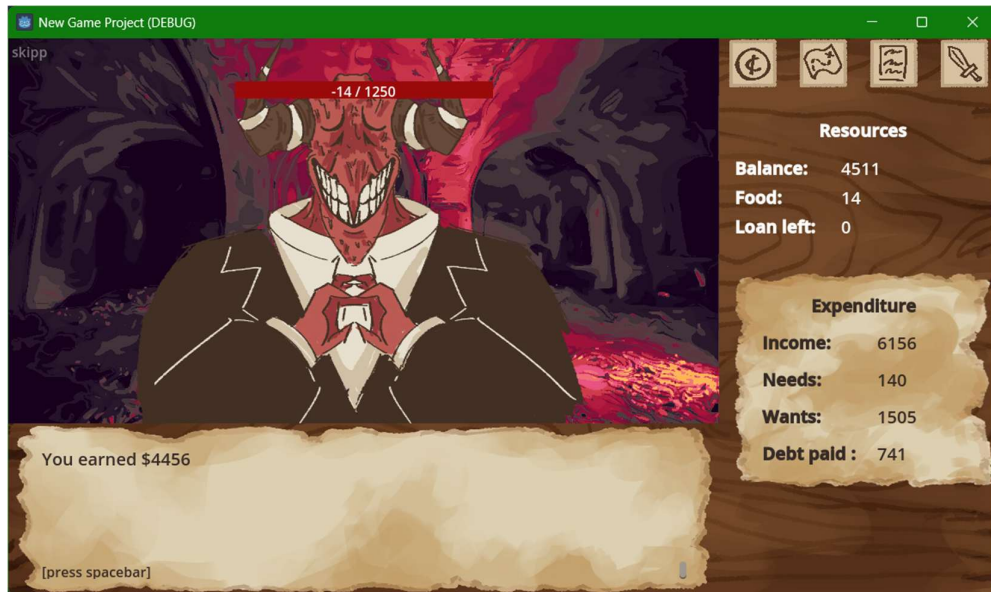


Figure 4.15 Currency drop after defeating the boss

4.3 Integrating all Elements

After all of the mechanics are tested individually and working properly, the conditions for each mechanics to appear in order are set, and the game's main menu is developed. In the full game, the shopping mechanic is able to be accessed three times, and the number of combat instances are randomized across gameplays.

4.4 Summary

This chapter details the sixth and eight step for the outcome-based methodology, which are integrating previous elements and integrating all game play elements. The assets used in the game are credited in this chapter, and the development of the game was made using Godot Engine. The LO Mechanics have been developed sequentially and then integrated into a full game by checking conditions for the mechanics and repeating certain mechanics.

CHAPTER 5: TESTING

5.1 Introduction

In this chapter, the seventh and the ninth step of the outcome-based methodology will be discussed. The steps are as follows:

- 1) Playtesting and evaluating each LO mechanic
- 2) Playtesting and evaluating the game as a whole

During and after the development of each LO mechanic, the elements are rigorously tested to ensure no errors or mistakes that would put off the player would occur. Upon integrating all game elements together, the mechanics are tested once more to ensure the game is seamless and the interaction between game elements function as expected. Once the game works properly, the game is playtested by young adults and the players are evaluated on their understanding of finance concept and feedback on the game is received. The effectiveness of the game-based learning environment is evaluated using pre-tests and post-tests.

5.2 Playtesting and evaluating each LO mechanic

Each gameplay mechanic and feature were playtested to ensure it runs smoothly and it is functioning correctly. Playtesting is also conducted after combining all mechanics into a single game. The results from the play tests are shown in Table 5.1.

Table 5.1 List of Playtested Game Mechanics with Their Functions, Expected Results and the Outcome

	Function	Expected Results	Pass/Fail
Main Menu	“Start” Button	Changes scene to the main game screen	Pass
Text box	Pressing spacebar	Moves to the next dialogue line	Pass
	Unlock side menu pages	Makes side menu buttons visible when certain dialogue lines appear	Pass
LO1 Mechanic	Clicking correct Wants/Needs/Income buttons	Increases the value in the respective categories, and increases or decreases the balance	Pass
	Clicking wrong Wants/Needs/Income buttons	Plays a sound and prompts user to try again	Pass
LO2 Mechanic	Clicking on building	Changes scene to inside store	Pass
	Clicking on buying food button	Changes scene to buying food scene	Pass
	Buying food	Units of food in Resources menu increases, Balance reduces based on price of food	Pass
	Clicking on upgrade skills button	Prompts player to choose whether they want to upgrade Brock or Claire	Pass
	Clicking on upgrade Brock button	Changes to upgrade Brock skills scene	Pass
	Upgrading/Buying any of Brocks skills	Progress bar under the skill increases, balance reduces, and skill increases	Pass
	Clicking on upgrade Claire button	Changes to upgrade Claire skills scene	Pass
	Upgrading/Buying any of Claires skills	Progress bar under the skill increases, price changes, balance reduces, and skill increases	Pass
	If any button with buying capabilities is clicked without sufficient balance	Tells player they cannot afford item	Pass

	Nevermind button clicked	Displays previous scene	Pass
	Leave city button clicked	Leave city scene If loan > 0, go to loan collection scene Else, continue journey	Pass
LO3 Mechanic	Check balance	If balance < minimum loan payment, go to losing scene	Pass
	Check progress	If player is at the first or second city, slider for loan payment will appear If player is at third city, button will appear to prompt use to pay full amount	Pass
	Check loan	If player is at first or second city: If loan > 100, slider will appear If loan < 100, button to pay full amount will appear	Pass
	Changing value of slider	Changes how much money the player pays back to the Loan Shark when button is pressed, changes the number shown on the payment button	Pass
	Pressing payment button	Pay Loan Shark based on the number shown on button, continues journey afterwards	Pass
Combat	Combat starts	Number of rounds is randomised, and enemy is randomised Both are displayed on screen Fight and Run button are enabled	Pass
	Selecting action from dropdown menu	the description below the dropdown changes according to selection	Pass
	SP check	If the action selected requires more SP than what the player has, the Fight button is disabled	Pass
	Claire's selected action heals a character	Another dropdown menu appears for player to assign the recipient of healing	Pass
	Fight button pressed	Enemy health reduced (if attacks are used) Text box displays the action taken by Brock and Claire and the damage dealt	Pass
	Enemy health depleted	Gain currency If there is another round, move on to the next round	Pass

		If none, continue journey	
	Brock or Claire health depleted	Combat gameplay ends, one unit of food is consumed, and the journey is continued	Pass
Combat Quiz	Question load	The question and its respective answer are shown in the text box. A 10 second timer appears and starts counting down.	Pass
	Timer timeout	Enemy attacks either Brock or Claire at maximum attack	Pass
	Correct answer selected	If answered under 5 seconds, either Brock or Claire gets little to no damage If answered over 10 seconds, either Brock or Claire gets reduced damage	Pass
	Wrong answer selected	Enemy attacks either Brock or Claire with increased damage	Pass
Losing conditions	Food = 0	Move to hunger losing screen, once dialogue finished, move back to main menu	Pass
	Balance < minimum loan payment	Move to loan losing screen, once dialogue finished, move back to main menu	Pass
	Lost in boss battle	Move to boss losing screen, once dialogue finished, move back to main menu	Pass
Win condition	Win in boss battle	Move to true ending screen, once dialogue finished, move back to main menu	Pass
Side menu	Click on coin button	Resources and Expenditure menu is visible	Pass
	Click on map button	Map menu is visible	Pass
	Journey/Day increases	The red dots on the Map menu changes to green	Pass
	Click on notes button	Notes menu is visible	Pass
	Click on combat button	Combat menu is visible	Pass

5.3 Playtesting and Evaluating the Game as a Whole

To evaluate the game's effectiveness as a game-based learning solution for educating young adults on budgeting, a playtesting session was conducted. Before and after playing the game, participants were tested on the topics covered in the game to assess their learning outcomes. A total of 34 young adults, aged between 18 and 27 years old, were randomly assigned to either a control group or an experimental group. Prior to testing, all participants were provided with a consent form. All testing was conducted online to ensure that the participants would be able to do the tests in their own time.

Both the control and experimental groups answered the same pre-test to establish a baseline understanding of budgeting concepts. The pre-test contained ten questions regarding budgeting, spending, saving and debt management. After finishing the pre-test, the groups were linked to their respective interventions. For the intervention phase, the control group was instructed to read the informational notes that are included in the game (see Appendix D) to emulate the traditional method of learning, while the experimental group played the game itself. To simplify access, the game was published as an HTML game on itch.io, allowing users to play it directly in their web browser without the need to download any files.

After the intervention, both groups completed the same post-test using Google Forms. The post-test aims to determine the participants understanding of the concepts taught after intervention. Like the pre-test, the post-test contained ten questions that are based on the same topics as the pre-test. The scores of the pre-test and post-test of both groups are then compared to evaluate the effectiveness of both the control and the experimental method. The Google Form for the pre-test and the post-test are included in Appendix E and Appendix F respectively.

5.3.1 Control Group Demographic Information

For the control group, there are a total of 17 participants that participated in both the pre-test and post-test. The post-test included the notes that were provided in the game for the participants to read through before answering the post-test and were informed that they would be quizzed on the contents after reading through.

Gender
17 responses

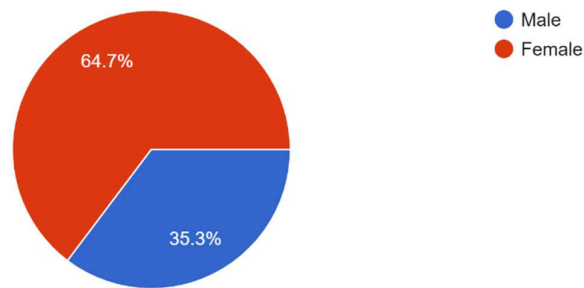


Figure 5.1 Gender of participants in control group

Figure 5.1 displays the gender of the participants who are part of the control group. Most of the control group consists of women, with female being the response of 64.7% of the participants. Male participants, on the other hand, make up 35.3% of the control group.

Age Group
17 responses

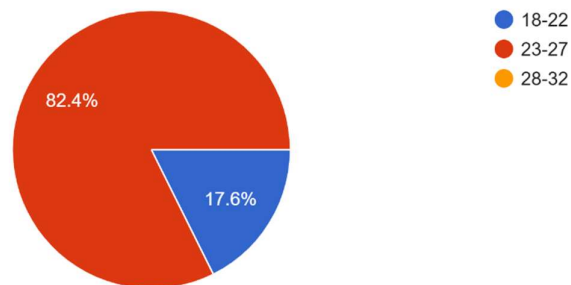


Figure 5.2 Age demographic of participants in control group

The age groups of the participants of the control group are displayed in Figure 5.2. Most of the participants are within the range of 23 to 27 years old, making up 82.4% of responses. Only 17.6% of the participants were within the age range of 18 to 22 years old.

Employment Status
17 responses

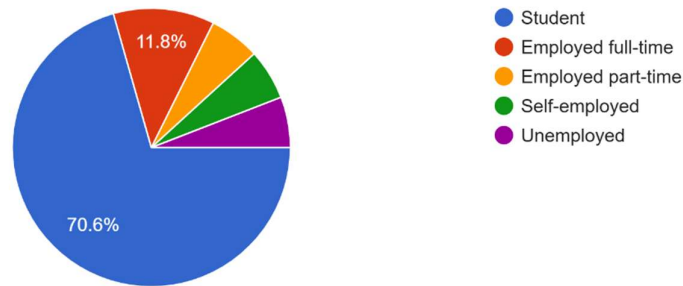


Figure 5.3 Employment status of participants in control group

The employment status of the control group's participants is displayed in Figure 5.3. Students made up 70.6% of the participants of the control group, whereas 11.8% of the participants were employed full-time. There was one participant each in the categories employed part-time, self-employed and unemployed.

Educational Background
17 responses

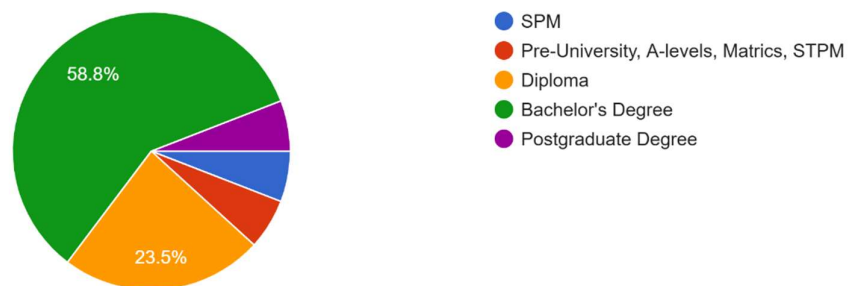


Figure 5.4 Educational background of participants in control group

Lastly, Figure 5.4 shows the educational background of the participants. Over half of the participants have a bachelor's degree (58.8%), followed by participants with a diploma (23.5%). The categories SPM, pre-university, and postgraduate degree had one participant each.

5.3.2 Experimental Group Demographic Information

For the experimental group, there are a total of 17 participants that participated in the pre-test and 15 that participated in the post-test. Two of the participants of the experimental group did not go through with the intervention phase as one of them did not have time to play the game, and the other realised that they were not the age demographic for the study.

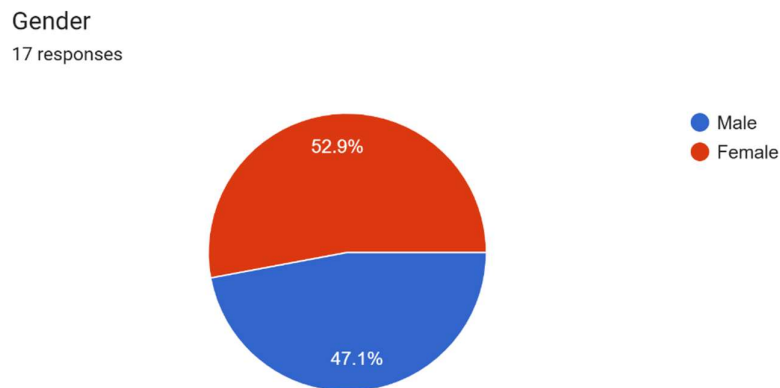


Figure 5.5 Gender of participants in experimental group

Figure 5.5 displays the gender of the participants. 52.9% of the participants identified as female, while the remaining 47.1% identified as male.

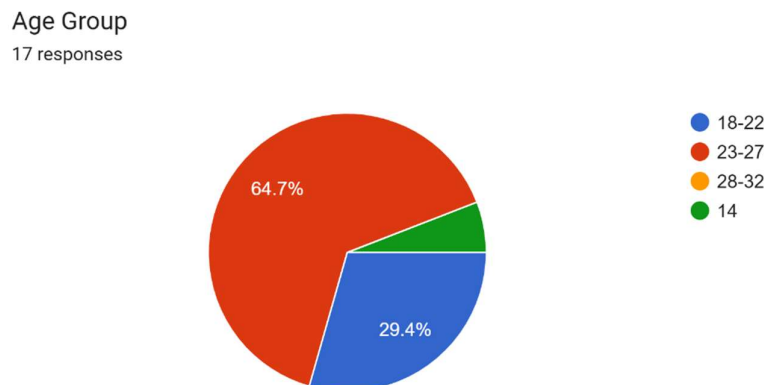


Figure 5.6 Age demographic of participants in experimental group

Figure 5.6 displays the age groups of the participants. The majority of participants were between the ages of 23 and 27 years old (64.7%). A smaller portion, 29.4%, were between 18 and 22 years old. Additionally, one participant, representing 5.9% of the group, was 14 years old.

Employment Status
17 responses

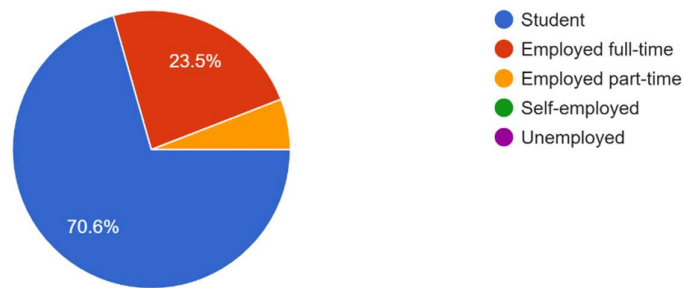


Figure 5.7 Employment status of participants in experimental group

The employment status of the participants is displayed in Figure 5.7. 70.6% of the participants were students, making them the dominant group in this category. Meanwhile, 23.5% were employed full-time, and 5.9% were employed part-time.

Educational Background
17 responses

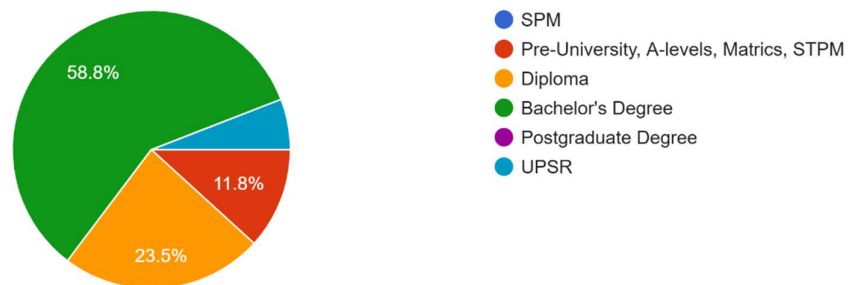


Figure 5.8 Educational background of participants in experimental group

Lastly, Figure 5.8 shows the educational background of the participants. A majority of participants (58.8%) held a bachelor's degree. Another 23.5% had completed a diploma, while 11.8% had a pre-university qualification. One participant (5.9%) reported having completed only UPSR, being the response of the 14-year-old participant.

5.3.3 Pre-test and Post-test Results

Upon the completion of both tests by the control group and the experimental group, the scores are compared against each other. The difference of scores between the pre-test and post-test is recorded. Only the scores of participants who complete both the pre-test and the post-test are evaluated. The pre-test and post-test scores of the control group participants are displayed in Table 5.2 whereas the pre-test and post-test scores of the experimental group participants are displayed in Table 5.3. The analytics of the post-test answers for both groups are displayed in Appendix G.

Table 5.2 Pre-test and post-test scores of control group participants

Student	Pre-test	Post-test	Difference
1	7	8	1
2	6	9	3
3	7	10	3
4	6	10	4
5	5	10	5
6	6	9	3
7	5	6	1
8	3	3	0
9	7	8	1
10	7	7	0
11	5	5	0
12	4	6	2
13	8	8	0
14	5	6	1
15	5	8	3
16	6	6	0
17	4	9	5
Mean	5.647059	7.529412	1.88

Table 5.3 Pre-test and post-test scores of experimental group participants

Student	Pre-test	Post-test	Difference
1	6	8	2
2	6	8	2
3	4	6	2
4	3	5	2
5	8	9	1
6	5	7	2
7	4	4	0
8	2	9	7
9	5	9	4
10	4	7	3
11	5	9	4
12	3	8	5
13	6	9	3
14	5	8	3
15	5	8	3
Mean	4.733333	7.6	2.87

According to Tables 5.2 and 5.3, the mean score of the control group increased from 5.65 in the pre-test to 7.53 in the post-test whereas the mean score of the experimental group increased from 4.73 in the pre-test to 7.6 in the post-test. The mean difference of the scores for the control group is 1.88, whereas for the experimental group, the mean difference of the scores is 2.87.

To determine the effectiveness of the game-based learning solution, a hypothesis testing using dependent samples t-test is utilized. The dependents samples t-test is used to compare the scores of the control group and the experimental group separately, and the results of the t-tests of both groups will be compared to determine which method is more effective to teach budgeting basics to young adults. Below are the null hypotheses of both the control group and the experimental group.

Control group:

- Null Hypothesis, H_{0_c} : There is no difference in pre-test and post-test scores completed by the control group. ($H_{0_c}: \mu_{control} = 0$)
- Alternative Hypothesis, H_{α_c} : There is a significant difference in pre-test and post-test scores completed by the control group. ($H_{\alpha_c}: \mu_{control} \neq 0$)

Experimental group:

- Null Hypothesis, H_{0_E} : There is no difference in pre-test and post-test scores completed by the experimental group. ($H_{0_E}: \mu_{experimental} = 0$)
- Alternative Hypothesis, H_{a_E} : There is a significant difference in pre-test and post-test scores completed by the experimental group. ($H_{a_E}: \mu_{experimental} \neq 0$)

The dependent sample t-test used to evaluate the scores of the control and the experimental groups used a 95% confidence interval (CI). The calculations of the dependent sample t-test were computed using Social Science Statistic's T-Test calculator for 2 Dependent Means and the results for the control group is displayed in figure 5.9, whereas the results for the experimental group is displayed in figure 5.10.

Significance Level:

- ☐ 0.01
☒ 0.05
☐ 0.10

One-tailed or two-tailed hypothesis?:

- ☐ One-tailed
☒ Two-tailed

Difference Scores Calculations

Mean: 1.88

$\mu = 0$

$$S^2 = SS/df = 49.76/(17-1) = 3.11$$

$$S^2_M = S^2/N = 3.11/17 = 0.18$$

$$S_M = \sqrt{S^2_M} = \sqrt{0.18} = 0.43$$

T-value Calculation

$$t = (M - \mu)/S_M = (1.88 - 0)/0.43 = 4.4$$

The value of t is 4.400731. The value of p is .00045. The result is significant at $p < .05$.

Figure 5.9 Screenshot of dependent sample t-test result for control group's pre-test and post-test

Significance Level:

- ☐ 0.01
☒ 0.05
☐ 0.10

One-tailed or two-tailed hypothesis?:

- ☐ One-tailed
☒ Two-tailed

Difference Scores Calculations

Mean: 2.87

$\mu = 0$

$S^2 = SS/df = 39.73/(15-1) = 2.84$

$S^2_M = S^2/N = 2.84/15 = 0.19$

$S_M = \sqrt{S^2_M} = \sqrt{0.19} = 0.43$

T-value Calculation

$t = (M - \mu)/S_M = (2.87 - 0)/0.43 = 6.59$

The value of t is 6.590363. The value of p is .00001. The result is significant at $p < .05$.

Figure 5.10 Screenshot of dependent sample t-test result for experimental group's pre-test and post-test

According to both Figure 5.9 and Figure 5.10, both groups' p-values are significant at $p < 0.05$, with the p-value of the control group being 0.00045, and the p-value of the experimental group being 0.00001. Therefore, the null hypotheses for the control group (H_{0_c}) and the experimental group (H_{0_E}) are rejected.

Upon comparing the results of both groups, a significant difference can be observed between the pre-test and post-test scores, as shown by the mean difference. The control group recorded a mean difference of 1.88, while the experimental group showed a higher mean difference of 2.87. Additionally, the p-value for the experimental group was notably lower than that of the control group, indicating that the improvement in the experimental group is statistically more meaningful. These findings suggest that the intervention introduced to the experimental group, which is the deployment of the game, had a greater positive impact on their budgeting knowledge compared to the control group. Therefore, the results support the effectiveness of the game-based approach in enhancing young adults' understanding of budgeting.

5.4 Feedback Obtained from I <3 Money Players

A Google Form was attached at the end of both post-tests for the participants to fill in after playing the game, but most players did not fill in the form. Therefore, not every player's feedback is able to be obtained. Those who had filled in the form and those who were observed while playtesting did not have much difficulty understanding the game mechanics. However,

not many players finished the game, often quitting after losing twice, and in some cases where the player was pressed for time, they would quit after losing once.

As the most challenging mechanic was the quiz mechanic, the players would go through the notes in order to be able to answer correctly. However, most would only skim through the notes throughout the gameplay and choose to learn through trial and error.

The players had also given constructive comments and suggestions, which are shown below:

- “I think that the game makes learning about budgeting fun and easier to understand”
- “I really liked how the game teaches budgeting in a fun way. The main strengths is that its educational but also engaging”
- “as someone who can’t be bothered to learn about my finance via reading this definitely taught me more stuff”
- “after getting an answer wrong it can be difficult to navigate the financial tips book, and the wrong answer doesn’t stay on screen so it makes it harder to figure out what you were supposed to choose”
- “Add a buff state/turn passive skill indicator, and a “go back” option to replay the previous character line”
- “Sometimes the game feels a bit repetitive, add more fun elements like minigames to make it more active”

5.5 Summary

This chapter details the seventh and ninth steps in the outcome-based methodology, which are playtesting the LO mechanics individually, and playtesting the game as a whole. The results of playtesting the LO mechanics by itself show that the game is running smoothly. Participants are then gathered to conduct a pre-test and post-test to evaluate the game’s effectiveness. The result of the test revealed that those who played the game as an intervention showed more improvement compared to those who read financial notes.

CHAPTER 6: CONCLUSION AND FUTURE WORKS

6.1 Introduction

The sixth and last chapter discusses if the project has achieved its objectives, the limitations and constraints faced during the project's development, and future improvements that can be made to the game developed in the project to be more effective in reaching its goal

6.2 Achievement of Project Objectives

Table 6.1 displays the project objectives outlined in Chapter 1, and a brief discussion on the achievement of the goal

Table 6.1 Project objective and their respective achievements

Project Objective	Achievement
To design a narrative game-based learning role-playing game about budgeting	I <3 Money was developed in Godot Engine using GDScript. The resulting game is a role-playing game that has game-based learning elements implemented within it. The narrative and goal of the game is to reach the end of the journey by budgeting their trip well.
To develop a game-based solution to educate young adults on budgeting basics	During the planning stages of the game, four LOs have been defined for the game, each aiming to increase the player's understanding of budgeting and financial concepts that align with budgeting. The gameplay and winning conditions of I <3 Money requires understanding and implementation of budgeting practices, as well as an understanding of debt management
To evaluate the effectiveness of using game-based learning to teach budgeting to young adults	The effectiveness of the game, I <3 Money, was evaluated using pre-tests and post-tests on an experimental group and a control group. The scores obtained from the tests were then evaluated using dependent

	samples t-test. The result of the t-test determined that the improvement shown by the participants who played I <3 Money as an intervention was more significant compared to the participants who learnt about budgeting through traditional means.
--	---

6.3 Discussion and Interpretation of Findings

Based on the results, the game-based learning method appeared to be more effective than the traditional reading-based approach in helping young adults learn about budgeting. While both groups improved after the intervention, the experimental group, which played the game, had a higher increase in their post-test scores. This suggests that the game's interactive format may have helped participants better understand and remember the concepts taught, compared to simply reading notes.

One possible reason for this could be that the game gave players the chance to apply what they learned through trial and error, which may have helped reinforce their knowledge. Unlike the control group, which just read through information, players in the experimental group had to actively engage with budgeting decisions and see the results of their choices. This type of learning experience aims to make the lessons more meaningful and easier to retain.

However, there were some issues that might have affected the learning experience for some players. A few participants did not finish the game, often stopping after one or two failed attempts. Some also mentioned that it was difficult to figure out the correct answers after getting something wrong, especially since the feedback was not always clear. This could have made it harder for them to learn from their mistakes and continue progressing through the game. Suggestions from the players to improve the learning environment include adding clearer feedback, adjusting the difficulty, or including more variety in the gameplay to keep it engaging.

Overall, the findings show that using a game-based method can be a useful way to teach financial literacy, especially for young people who may find reading through notes less engaging.

6.4 Constraints and Limitations

There were several constraints and limitations faced during the development of this project. One of the main limitations was time. As this project had to be completed within the academic semester, there was limited time to fully polish all aspects of the game or include additional features that were initially planned, such as more story content or more variety in gameplay.

Another limitation was the topic itself. As the original objective of the game was to educate on budgeting, the game's LOs could only be about budgeting. Many young adults are aware of budgeting practices and know basic budgeting but are not aware of other personal finance topics that will affect how they spend and plan their expenses. To overcome this realisation, debt management was added into the LOs as part of the budgeting syllabus because debt will affect the way a budget is planned. Debt management is also a topic that most young adults have less knowledge on but is important to know as most young adults who graduate from university take loans to pay for their tuition.

Lastly, as the game reuses game mechanics, the gameplay is repetitive and lacks interaction. The game is also hard to win due to its reliance on luck to gain money. In some cases, the questions start repeating within the same instance of combat. This has caused players to feel bored after repetitively playing in attempts to win the game. Furthermore, the game lacks basic features such as settings and save/load functionality. Without the ability to adjust game preferences or save progress, players are required to restart from the beginning each time, which can be frustrating and discouraging. These limitations reduce the overall user experience and may affect players' motivation to continue engaging with the game for learning purposes.

6.5 Future Works and Recommendations

There are several areas where the project could be improved in future work. Upon deliberation, these are the recommendations that are made:

1. Incorporating adaptive difficulty and personalized learning paths to accommodate players with varying levels of financial literacy.
2. Expand the financial topics covered, such as investment planning, insurance literacy, and retirement savings to educate young adults on the steps they must take
3. Multi-language support and mobile platform compatibility should be considered to reach a broader audience and improve accessibility
4. A save/load function should be implemented to allow players to go back and change their choices, as well as continue their playthrough at a later time.

5. Visual cues should be added to the combat mechanic. For example, indicators should be added in the quiz portion to inform the user of the correct choice and what topic the question correlates to, and the player should be informed of how many turns are left for the buff.
6. More gameplay elements should be added to increase the engagement of the game. Research should be done to ensure the gameplay mechanics included can improve the learning experience for the player.

6.6 Summary

This chapter presented the final evaluation of the “I <3 Money” game and reflected on the constraints faced throughout the development process. While the project successfully demonstrated the potential of game-based learning for teaching budgeting to young adults, it also highlighted key limitations, such as time, topic constraints, and repetitive gameplay. Based on these findings, several recommendations were proposed for future improvements, including expanding the game’s content, enhancing personalization, and having multi language support and a mobile platform. Overall, the project lays a solid foundation for further exploration into serious games as educational tools for financial literacy.

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APPENDICES

Appendix A

Gantt Chart for FYP 1

Task Name/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Brief Proposal Submission and Approval														
Full Proposal Submission														
Chapter 1 Preparation														
Chapter 2 Preparation														
Conduct Survey and Review EBU 1063 Learning Materials														
Chapter 3 Preparation														
FYP 1 Final Report Submission														

Appendix B

Gantt Chart for FYP 2

Task Name/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Revised FYP Report and Gantt Chart Submission														
Implementation and Integration of LO Mechanics														
Playtest														
Chapter 4 Preparation														
Chapter 5 and 6 Preparation														
Submission of FYP for supervisor to review														
Submission of Final Report, Source Code, User Manual and Paper for Assessment														

Appendix C

Contents of Google Form Survey

1/13/25, 10:04 PM

Survey for Insight on Educational Game about Budgeting

Survey for Insight on Educational Game about Budgeting

Consent Form

Hello, my name is Huda Nadhirah. I am a final year Multimedia Computing student from the Faculty of Computer Science and Information Technology in UNIMAS. I humbly request for you to take part in this survey which is part of my final year project, "**I <3 Money, Teaching Budgeting Basics through Game-Based Learning**" where I will be developing an educational game about budgeting for young adults.

This survey aims to identify the knowledge and mindset that young adults have on budgeting. It also aims to collect information on their perspective on the development of educational games. Your participation will be very helpful to achieve my research goals and guide me throughout the process of developing the game.

This survey consists of **four sections**;

1. Demographic Information (5 Questions)
2. Financial Habits and Challenges (4 Questions)
3. Financial Knowledge (5 Questions)
4. Gaming Preferences and Feedback (8 Questions)

Your participation in this survey is voluntary and you can withdraw at anytime with no consequences. The data from this survey can be viewed by me and my supervisor, Dr. Amelia Jati Anak Robert Jupit, and may be published in the future, however you will not be able to be identified through the data, as it will be collated. Rest assured, your anonymity and the confidentiality of your survey responses will be maintained.

Any questions can be sent to my email, **78030@siswa.unimas.my**. Thank you very much for participating in my survey.

* Indicates required question

1. If you have read the above information and give your consent to take part in this research survey please select the "I agree" option. *

Mark only one oval.

☐ I agree

Demographic Information

This section helps us gather basic information about you to understand the backgrounds of participants

<https://docs.google.com/forms/d/15JeJCIOHcNUMyXC-STM0BvwCxxkLMY3aB4KecjgyjMqY/edit>

1/9

2. Gender *

Mark only one oval.☐ Male☐ Female

3. Age Group *

Mark only one oval.☐ 18-22☐ 23-27☐ 28-32☐ Other: _____

4. Employment Status

Mark only one oval.☐ Student☐ Employed full-time☐ Employed part-time☐ Self-employed☐ Unemployed☐ Other: _____

5. Educational Background *

Mark only one oval.

- ☐ SPM
- ☐ Pre-University, A-levels, Matrics, STPM
- ☐ Diploma
- ☐ Bachelor's Degree
- ☐ Postgraduate Degree
- ☐ Other: _____

6. Approximate Monthly Income/Allowance *

Mark only one oval.

- ☐ RM300 and below
- ☐ RM300 - RM500
- ☐ RM500 - RM700
- ☐ RM700 - RM 900
- ☐ RM900 and above

Financial Habits and Challenges

This section explores your current financial behaviors and challenges to identify key areas where the game can provide value.

7. How often do you create and follow a personal budget? *

Mark only one oval.

- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

8. What method(s) do you use to track your expenses? (Select all that apply) *

Tick all that apply.

- ☐ Mobile Apps
- ☐ Spreadsheets
- ☐ Written notes
- ☐ No Tracking
- ☐ Other: _____

9. What are your biggest financial challenges? (Select up to three) *

Tick all that apply.

- ☐ Saving money
- ☐ Managing debt
- ☐ Sticking to a budget
- ☐ Planning for future goals
- ☐ Impulse spending
- ☐ Other: _____

10. How confident are you in your financial knowledge and skills? *

Mark only one oval.

- ☐ Very confident
- ☐ Confident
- ☐ Neutral
- ☐ Not very confident
- ☐ Not confident at all

Financial Knowledge

This section assesses your familiarity with financial concepts and tools to tailor the game's educational content

11. Have you received any formal education or training in personal finance or budgeting? *

Mark only one oval.

- ☐ Yes
☐ No
☐ Maybe

12. How often do you seek out resources to increase your financial literacy? *

Mark only one oval.

- ☐ Often
☐ Sometimes
☐ Rarely
☐ Never

13. Where do you usually gain personal finance knowledge from? (Select all that apply) *

Tick all that apply.

- ☐ Books
☐ Courses
☐ Social Media Influencers
☐ Financial Advisors
☐ Family or Friends
☐ Other: _____

14. How would you rate your understanding of the flowing financial topics *

Mark only one oval per row.

	No understanding	Some understanding	Moderate understanding	Excellent understanding
Budgeting	☐	☐	☐	☐
Saving strategies	☐	☐	☐	☐
Debt management	☐	☐	☐	☐
Emergency funds	☐	☐	☐	☐

15. Which of the following budgeting techniques are you familiar with? (Select all that apply) *

Tick all that apply.

- ☐ 50/30/20 rule
☐ Zero-based budgeting
☐ Envelope method
☐ Automated Savings
☐ Other: _____

Gaming Preferences and Feedback

This section gathers insights into your gaming habits and preferences to design an engaging experience.

16. How often do you play video games? *

Mark only one oval.

- ☐ Often
☐ Sometimes
☐ Rarely
☐ Never

17. What device do you usually use to play games? *

Tick all that apply.

- ☐ PC
☐ Mobile device
☐ Consoles

18. What type of games do you enjoy the most? *

Tick all that apply.

- ☐ Strategy
☐ Simulation
☐ Puzzle
☐ Adventure
☐ RPG
☐ Visual Novel
☐ Other: _____

19. Would you be interested in a budgeting game? *

Mark only one oval.

- ☐ Yes
☐ No
☐ Maybe

20. What features would make a budgeting game appealing to you? *

Tick all that apply.

- ☐ Realistic financial scenarios
- ☐ Customizable characters
- ☐ Rewards for achievements
- ☐ Multiplayer/Competitive modes
- ☐ Simple and easy to use interface
- ☐ Other: _____

21. Would you prefer a game that teaches financial concepts directly or one that focuses *
on simulating real-life budgeting challenges?

Mark only one oval.

- ☐ Teaching financial concepts
- ☐ Simulating real life challenges
- ☐ A mix of both

22. How much time would you ideally spend on a budgeting game per session? *

Mark only one oval.

- ☐ Less than 15 minutes
- ☐ 15- 30 minutes
- ☐ 30-45 minutes
- ☐ More than 45 minutes

23. Do you have any suggestions for features or content that should be included in the game?

24. If you would like to play-test the game when it has been completed, please enter your email below :)

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Google Forms

20. What features would make a budgeting game appealing to you? *

Tick all that apply.

- ☐ Realistic financial scenarios
- ☐ Customizable characters
- ☐ Rewards for achievements
- ☐ Multiplayer/Competitive modes
- ☐ Simple and easy to use interface
- ☐ Other: _____

21. Would you prefer a game that teaches financial concepts directly or one that focuses *
on simulating real-life budgeting challenges?

Mark only one oval.

- ☐ Teaching financial concepts
- ☐ Simulating real life challenges
- ☐ A mix of both

22. How much time would you ideally spend on a budgeting game per session? *

Mark only one oval.

- ☐ Less than 15 minutes
- ☐ 15- 30 minutes
- ☐ 30-45 minutes
- ☐ More than 45 minutes

Appendix D

Financial Notes Included in “I <3 Money” and the Post-test of the Control Group

1. Evaluate Your Financial Health

Income Tracking

- Tracking income means recording all regular earnings like salary, freelance work, or passive income.
- **Gross income** is before deductions; **net income** is what you take home.
- Helps set realistic budgets and avoid overspending.

Expense Tracking

- Track both fixed expenses (e.g., rent, subscriptions) and variable ones (e.g., food, shopping).
- Categorizing helps identify spending patterns and areas to cut back.

Needs vs. Wants

- **Needs** are essentials like rent, food, and healthcare.
- **Wants** are extras like entertainment or luxury items.
- Ask: *Can I live or work without this?*

Using a Balance Sheet

- A balance sheet shows your financial position.
 - List **assets**: cash, investments, retirement funds, and valuables.
 - List **liabilities**: unpaid bills, loans, and debts.
 - **Net worth = assets - liabilities**
- A positive net worth is ideal; a negative one means you owe more than you own.

2. Smart Spending

Apply Budgeting

- Use your income to plan expenses and savings.
- Popular budgeting techniques:
 - **50/30/20 Rule**: 50% Needs, 30% Wants, 20% Savings/Debt
 - **Envelope Method**: Allocate cash to categories
 - **Zero-Based Budget**: Assign every ringgit a purpose

Avoid Revenge Spending

- Revenge spending is buying everything you couldn't afford in the past.

- To overcome: **control spending** on wants and **shift your mindset**.

Avoid Impulse Spending

- Buying without planning is often emotional.
- Use a shopping list or delay your purchase for 24 hours to avoid regrets.

Lifestyle Creep

- Happens when spending increases with income.
- Avoid by maintaining your existing budget after earning more.

Individual Tax Relief

- Keep receipts of important purchases to claim tax relief
- Reduces the amount of tax you pay
- Examples of individual tax relief types :
 - Education fees
 - Medical expenses
 - Monthly internet subscription, etc.
- You can check what tax relief you are entitled to on the LHDN website

3. Define Your Financial Goals

- Set goals by timeframe:
 - **Short-term:** within 1 year
 - **Mid-term:** 1–10 years
 - **Long-term:** over 10 years
- Write them down and revise as needed.
- Use the **SMART** framework: **Specific, Measurable, Achievable, Relevant, Time-bound**.
 - Example: *Save RM100 weekly for 3 months.*

4. Saving

Emergency Fund

- Should cover 3–6 months of expenses.
- Use only for unexpected events like job loss or medical bills.

Retirement Savings

Start early to grow wealth over time.

Use low risk investment options:

- Amanah Saham Bumiputera (ASB)
- Private Retirement Schemes (PRS)
- Unit Trust Funds
- EPF

Financial Goal Savings

Keep separate from emergency or retirement savings.

Adjust spending to allocate money toward specific goals.

5. Understanding Debt

Debt is borrowed money you're obligated to repay.

- **Secured debt:** backed by assets (e.g., car, home)
- **Unsecured debt:** no collateral (e.g., credit cards, personal loans)

Always understand the interest rate and repayment terms before borrowing.

Good vs. Bad Debt

Good debt builds value or income (e.g., education loans, mortgages, business loans).

Bad debt is high-interest and for non-essentials (e.g., personal loans, credit card loans).

Minimum Payments

Only paying the minimum on loans or credit cards increases **long-term debt**.

Paying in full helps **avoid interest** and late fees.

6. Credit Reporting in Malaysia

There are two credit reporting systems in Malaysia : CCRIS and CTOS

CCRIS

- Central Credit Reference Information System (CCRIS) run by Bank Negara Malaysia
- Provides a **factual report** on an individuals borrowing history
- Used by financial institutions to evaluate a borrowers risk

CTOS

- Private credit reporting agency
- Provides **CTOS score**; a numerical representation of a person's creditworthiness

- Lenders use CTOS score to evaluate how reliable a borrower at repaying debts
- A score below **528** is considered poor

CCRIS and CTOs reports allow banks to assess whether a borrower is **capable of repaying their debt**

Banks will use the reports to calculate how much of your income is used to pay debts

A higher CTOS score will increase the chance of getting your loans approved, whereas a lower score has a higher chance of loan rejection.

Appendix E

Pre-test Questions

7/8/25, 8:58 AM

Pre-Test for I <3 Money

Pre-Test for I <3 Money

Consent Form

Hello, my name is Huda Nadhirah. I am a final year Multimedia Computing student from the Faculty of Computer Science and Information Technology in UNIMAS. I humbly request for you to take part in this pre-test which is part of my final year project, "**I <3 Money, Teaching Budgeting Basics through Game-Based Learning**" where I will be developing an educational game about budgeting for young adults.

My research aims to investigate the effectiveness of using game-based learning to teach budgeting to young adults. Your participation will be very helpful to achieve my research goals and guide me throughout the process of developing the game.

This pre-test consists of **two sections**;

1. Demographic Information (5 Questions)
2. Budgeting and Financial Knowledge Quiz (10 Questions)

Your participation in this pre-test is voluntary and you can withdraw at anytime with no consequences. The data from this pre-test can be viewed by me and my supervisor, Dr. Amelia Jati Anak Robert Jupit, and may be published in the future, however you will not be able to be identified through the data, as it will be collated. Rest assured, your anonymity and the confidentiality of your responses will be maintained.

Any questions can be sent to my email, **78030@siswa.unimas.my**. Thank you very much for participating in my pre-test.

* Indicates required question

1. If you have read the above information and give your consent to take part in this research survey please select the "I agree" option. *

Mark only one oval.

☐ I agree

2. Name

Don't worry, this is only used to compare your marks to your post-test, your anonymity will be maintained :)

Demographic information

This section helps us gather basic information about you to understand the backgrounds of participants

3. Gender *

Mark only one oval.

- ☐ Male
☐ Female

4. Age Group *

Mark only one oval.

- ☐ 18-22
☐ 23-27
☐ 28-32
☐ Other: _____

5. Employment Status

Mark only one oval.

- ☐ Student
☐ Employed full-time
☐ Employed part-time
☐ Self-employed
☐ Unemployed
☐ Other: _____

6. Educational Background *

Mark only one oval.

- ☐ SPM
- ☐ Pre-University, A-levels, Matrics, STPM
- ☐ Diploma
- ☐ Bachelor's Degree
- ☐ Postgraduate Degree
- ☐ Other: _____

Budgeting and Financial Knowledge (10 Questions)

This section explores your current financial behaviors and challenges to identify key areas where the game can provide value.

7. Which one of these acronyms refer to a way of structuring financial goals *

1 point

Mark only one oval.

- ☐ EPF
- ☐ 5Cs
- ☐ SMART
- ☐ CAGR

8. Buying something just because it's on sale is often an example of... *

1 point

Mark only one oval.

- ☐ Saving
- ☐ Planning
- ☐ Impulse
- ☐ Investment

9. How do you calculate net worth? *

1 point

Mark only one oval.

- ☐ Assets - debt
- ☐ Income - expenses
- ☐ Assets - liabilities
- ☐ Liabilities - expenses

10. What category does entertainment expenses fall under? *

1 point

Mark only one oval.

- ☐ Need
- ☐ Fun
- ☐ Want
- ☐ Self-reward

11. Which is NOT a budgeting method? *

1 point

Mark only one oval.

- ☐ Envelope method
- ☐ Zero-based budgeting
- ☐ 3P budgeting
- ☐ 50/30/20 budget rule

12. What part of the SMART goal acronym refers to if the goals progress can be monitored * 1 point

Mark only one oval.

- ☐ Specific
☐ Measurable
☐ Realistic
☐ Achievable

13. What is a characteristic of bad debt? * 1 point

Mark only one oval.

- ☐ Backed with assets
☐ High interest
☐ Decreases credit score
☐ Low interest

14. Long-term goals usually take * 1 point

Mark only one oval.

- ☐ Above 5 years
☐ Over 2 years
☐ Over 10 years
☐ Below 7 years

15. How many months of expenses should an emergency fund cover? *

1 point

Mark only one oval.

☐ 12

☐ 3

☐ 6

☐ 8

16. What will happen when you do not pay the minimum payments for debt? *

1 point

Mark only one oval.

☐ Reduced interest rate

☐ Revoked bank access

☐ Late fee penalty

☐ Increased credit score

End of Test

Thank you so much for your contribution :D

You are part of my control group therefore you are sent straight to Post-Test!

Please click [here](#) for the Post-Test!

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Appendix F

Post-test Questions

7/8/25, 8:59 AM

Post-test Form for I <3 Money

Post-test Form for I <3 Money

Consent Form

Hello, my name is Huda Nadhirah. I am a final year Multimedia Computing student from the Faculty of Computer Science and Information Technology in UNIMAS. I humbly request for you to take part in this post-test which is part of my final year project, "**I <3 Money, Teaching Budgeting Basics through Game-Based Learning**" where I will be developing an educational game about budgeting for young adults.

My research aims to investigate the effectiveness of using game-based learning to teach budgeting to young adults. Your participation will be very helpful to achieve my research goals and guide me throughout the process of developing the game.

This Post-test consists of **two sections**;

1. Demographic Information (5 Questions)
2. Budgeting and Financial Knowledge Quiz (10 Questions)

Your participation in this survey is voluntary and you can withdraw at anytime with no consequences. The data from this survey can be viewed by me and my supervisor, Dr. Amelia Jati Anak Robert Jupit, and may be published in the future, however you will not be able to be identified through the data, as it will be collated. Rest assured, your anonymity and the confidentiality of your responses will be maintained.

Any questions can be sent to my email, **78030@siswa.unimas.my**. Thank you very much for participating in my post-test.

* Indicates required question

1. If you have read the above information and give your consent to take part in this research survey please select the "I agree" option. *

Mark only one oval.

☐ I agree

2. Name: *

This is only used to compare the scores with the pre-test, your anonymity will be secured :)

Budgeting and Financial Knowledge (10 Questions)

https://docs.google.com/forms/d/1IC0VACZpSHVOqplcPt7waQ8YZzOJ_7S7dff2cPrtoR8/edit

1/6

3. The best practice when paying off credit card debt is to _____ every month. * 1 point

Mark only one oval.

- ☐ Pay minimum
☐ Save money
☐ Pay in full
☐ Report fraud

4. An example of bad debt is _____. * 1 point

Mark only one oval.

- ☐ Personal loan
☐ Car loan
☐ Mortgage
☐ Business loan

5. Impulse spending is _____. * 1 point

Mark only one oval.

- ☐ Planned buying
☐ Extreme buying
☐ Frustration buying
☐ Emotional buying

6. Which item is typically a fixed expense *

1 point

Mark only one oval.

- ☐ Internet subscription
- ☐ Weekly groceries
- ☐ Medical bills
- ☐ Gas bill

7. What improves with responsible debt use? *

1 point

Mark only one oval.

- ☐ Account rating
- ☐ Credit score
- ☐ Interest rates
- ☐ Salary

8. What is good debt? *

1 point

Mark only one oval.

- ☐ Debt for charity reasons
- ☐ Debt that will not affect your budget or expenses
- ☐ Debt that builds value or income
- ☐ Debt that can be paid back immediately

9. The Envelope method of budgeting refers to _____. *

1 point

Mark only one oval.

- ☐ Storing all income into an envelope
- ☐ Storing all proof of payment into envelopes
- ☐ Dividing proof of payments of separate categories into envelopes
- ☐ Dividing money for specific expenses in envelopes

10. A CTOS score below what number is considered poor? *

1 point

Mark only one oval.

- ☐ 600
- ☐ 550
- ☐ 655
- ☐ 528

11. On what occasion is it appropriate to use money from your emergency fund? *

1 point

Mark only one oval.

- ☐ Repairing phone
- ☐ Buying last-minute birthday gift
- ☐ Paying off subscriptions
- ☐ Paying credit card debt

12. What is it called when your expenditures increase with your salary? *

1 point

Mark only one oval.

- ☐ Leveling up in life
- ☐ Interest
- ☐ Inflation
- ☐ Lifestyle creep

End of post-test!

Thank you so much for your participation! Please continue to the user satisfaction form through the link below!

<https://forms.gle/6RUH4ebfhA7DxqUZ6>

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Appendix G

Post-test results from both Control and Experimental Group

Q1

The best practice when paying off credit card debt is to ____ every month.					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Pay in full		14		11	25
Pay minimum			2		2
Save money	3		2		5
Grand Total	3	14	4	11	32

Q2

An example of bad debt is ____.					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Mortgage	2		1		3
Personal loan		15		14	29
Grand Total	2	15	1	14	32

Q3

Impulse spending is ____.					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Emotional buying		10		11	21
Frustration buying	4		4		8
Extreme buying	3				3
Grand Total	7	10	4	11	32

Q4

Which item is typically a fixed expense					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Internet subscription		14		13	27
Weekly groceries	1		2		3
Gas bill	2				2
Grand Total	3	14	2	13	32

Q5

What improves with responsible debt use?					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Account rating			1		1
Credit score		16		11	27
Interest rates			3		3
Salary	1				1
Grand Total	1	16	4	11	32

Q6

What is good debt?					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Debt that builds value or income		13		12	25
Debt that can be paid back immediately	3		2		5
Debt that will not affect your budget or expenses	1		1		2
Grand Total	4	13	3	12	32

Q7

The Envelope method of budgeting refers to ____.					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Dividing money for specific expenses in envelopes		10		9	19
Dividing proof of payments of separate categories into envelopes	5		3		8
Storing all proof of payment into envelopes	2		3		5
Grand Total	7	10	6	9	32

Q8

A CTOS score below what number is considered poor?					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
528		14		12	26
550	1		1		2
600			1		1
655	2		1		3
Grand Total	3	14	3	12	32

Q9

On what occasion is it appropriate to use money from your emergency fund?					
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Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Paying credit card debt	7		7		14
Repairing phone		10		8	18
Grand Total	7	10	7	8	32

Q10

What is it called when your expenditures increase with your salary?					
Answers/Score	Control		Experimental		Grand Total
	0.00 / 1	1.00 / 1	0.00 / 1	1.00 / 1	
Inflation	5		1		6
Leveling up in life			1		1
Lifestyle creep		12		13	25
Grand Total	5	12	2	13	32