

Financial literacy Gamification with voice assistant.

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Financial literacy Gamification with voice assistant (APIs)

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Abstract

The following research introduces the design and implementation of a modular, web-based financial literacy video game with the aim of contributing to the understanding of four financial concepts: cash, debt, savings, and investment risk. A prototype game has been developed using HTML, CSS, and JS single-file code. The code has been deployed in Visual Studio Code and hosted in Google Sites. The gamification techniques implemented in the prototype game include quizzes, decision-making scenarios, and quests, each of which is followed by feedback grounded in learning principles. An automatic voice assistant was implemented (browser-based speech synthesis), which enhances engagement. Evaluation is provided through self-simulated testing, and the site's link is included in this work to allow users to test and experience the gameplay of such an amazing creation. The prototype is feasible, accessible, and academically coherent, with limitations like real user testing and limited adaptability of the voice component. Future work should explore structured user trials, AI-driven live feedback, platform compatibility, and partnerships for scalability, with the potential for commercialization as a valuable and successful financial education tool.

1 Introduction

Financial literacy is a valuable life skill and a significant advantage for improving economic participation and individual well-being; yet research consistently shows that levels remain low across many populations (OECD/INFE, 2023). According to the Department of Finance (2024), Ireland's *National Financial Literacy Strategy 2025* emphasizes the need for innovative approaches to help citizens acquire essential knowledge about money management and make informed financial decisions. The gig economy, including banking and cryptocurrency, is an example of today's complex digital financial ecosystem that has changed how people expend money and has raised the demand for functional, behavior-informed financial literacy. is actively reshaping economic behavior.

Traditional education often fails to deliver effective results, especially for young people, where interaction, emotional engagement, and reinforcement of knowledge are essential cornerstones of an innovative educational strategy.

To improve financial education, the writer has researched dynamic and practical ways that can be applied to improve financial literacy. The suggestion is to innovate financial education by implementing financial games, along with a voice assistant. Such an idea combines technology and pedagogy to provide a practical, impactful, and engaging way to improve financial literacy in people.

Research shows that gamification can increase engagement and knowledge retention in financial literacy programs (*Bayuk and Altobello, 2019; Hamari et al., 2016*).

The seriousness of the games creates a safe and controlled environment, allowing players to simulate decisions, experience experimenting with financial behavior, and live with consequences without risking their own money (*Hoseiny and Niknafs, 2020; Bogost, 2005*).

The use of game-based learning can extraordinarily improve financial literacy levels.

Games can simulate real-world financial scenarios, cultivate confidence in economic behavior, and foster engagement.

Application Programming Interfaces (APIs) can have a significant impact on gamification, particularly in terms of deeper integration, personalization, and scalability.

This project aims to develop a web-based financial literacy game prototype that integrates quizzes, decision-making scenarios, and quests across four key modules: cash, debt, savings, and investment risk. The modules supported by Browser voice synthesis are used to deliver pre-scripted guidance and feedback, increasing immersion and accessibility. Emerging

technologies, such as APIs implemented in a financial video game, could reshape financial education, as well as Large Language Models. This can provide more personalized feedback and scalability. The ultimate goal is to demonstrate how impactful emerging technologies and interactive digital tools can help learners build financial confidence, reinforce positive money habits, and be prepared to make informed decisions in this complex economy.

An architectural diagram comparing a conventional financial video game with a financial video game featuring voice assistant implementation is shown in Figure 1.

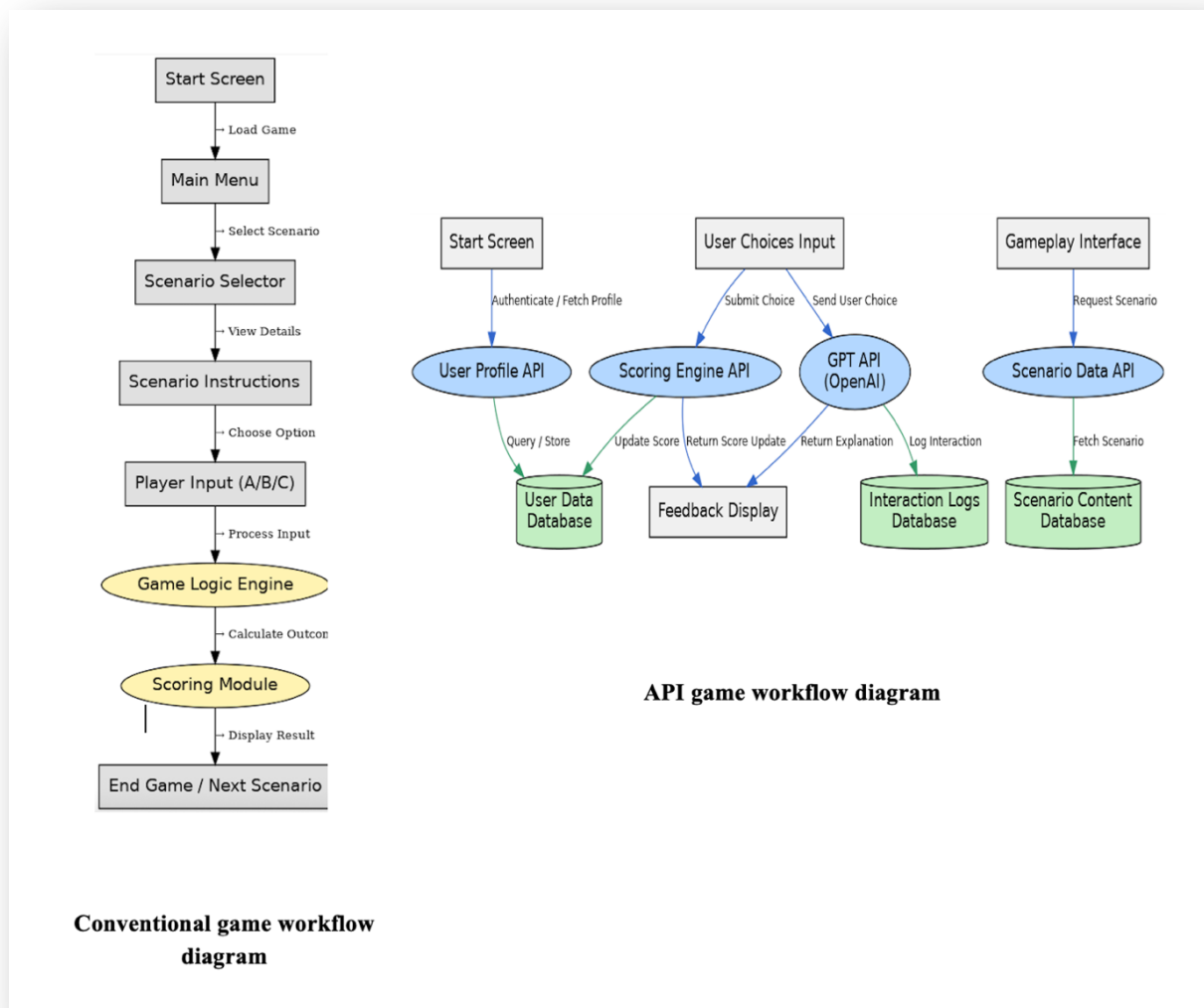


Fig 1. Conventional game workflow vs voice assistant game workflow diagrams.

2 Financial Literacy in Ireland: Policy Efforts and Educational Shortcomings.

According to the OECD (2014), many students don't understand what an interest rate is, nor do they know about the diversification of financial products, or they lack the basic ability to interpret a budget effectively.

During the BlockW and *Institute of Bankers (IOB) panel event* titled “*Bringing the gap in Digital & Financial Inclusion*” (National College of Ireland, May 1st, 2025), it was stated by Mairead McGuinness, European Commissioner for Financial Services, that while Generation Z, and above generations, are highly proficient in digital technologies they often face significant gaps in financial literacy (personal communication, 2025).

Financial literacy is becoming a trend-concern even for governments. A notable example is the National Financial Literacy Strategy 2025 Action Plan, published on 20 February 2025 by Paschal Donohoe, Minister of Finance, in the Republic of Ireland. Such a strategy is to complement financial literacy with education to increase the levels of financial consumer protection. The metrics for achieving such an ambitious plan include financial awareness, knowledge, skills, behavior, and attitudes towards money (OECD, 2020).

The 2025 Action Plan is the first of its kind implemented in Ireland. Such a Financial Literacy strategy can be summarized as follows:

Stream focuses on establishing structures, where the importance of governance is highlighted to ensure accountability, and the relationship with stakeholders is established to create a collaborative network that addresses systemic challenges.

This first stream is highly relevant to the current research project for the following reason: the creation of a central digital hub. This digital platform will provide financial literacy resources to make financial education more accessible and *user-friendly*, particularly for underserved groups.

Stream two aims to provide guidance, with the paramount importance of this project research being the evaluation and monitoring aspect, which assesses the impact of initiatives and empowers individuals with awareness and informed decision-making.

Finally, stream three focuses on the transformation of underserved groups and addresses specific financial literacy challenges (Department of Finance, 2024).

National initiatives, such as the *Irish National Financial Literacy Strategy 2025 Action Plan*, represent a significant step forward in delivering a high-quality and effective financial education program across society. The integration of meaningful and practical financial education in Ireland's schools should be consistent and realistic, including the implementation of technology tools.

Institutions may have launched financial education programs; however, it is essential to consider that such programs must be designed to generate a positive impact on students, accompanied by high retention and behavioral change.

According to Sustainability (2023), current financial education methods lack connection to learners' real-life contexts, particularly among digital native populations. Those gaps are not necessarily academic, but they translate to real consequences – leading to credit misuse, a lack of savings habits, and economic vulnerability that can persist in the long term.

2.1 The Gamification of Learning: from Theory to Practice

The gamification of learning represents a pedagogical innovation that transitions from abstract, theoretical teaching to experimental and active learning. This approach can be explained briefly with the following three theories:

- A. Kolb's Theory of Experimental Learning. This theory highlights the importance of learning in an efficient way through action, reflection, and adaptation.
- B. The Theory of Self-Determination. It realized an effective way to learn through autonomy, mastery, and motivation.
- C. Behavioral Economics. Argues that learning is linked to emotional outcomes and decisions fosters habit formation.

In Bogost (2005) and Gee (2007), the authors argue that video games align with these theories through their related tasks. They agree that video games help players improve skills in problem-solving, reward feedback cycles, and develop situational awareness through the simulation of consequences – these are the right conditions under which financial knowledge can evolve into financial behavior.

According to the research (Shoeib Hoseiny & Abbas Niknafs, 2020) and ING International (2014) the authors provide an empirical backing. They observed that students who were involved in financial simulation games demonstrated higher retention, an improvement in financial confidence, and a tremendous capacity to apply concepts learnt in real-life scenarios.

2.2 The Innovative Advance of Financial Literacy Games

In the last two decades, substantial efforts have been made on financial game design, where three pillars have been the cornerstone of their effectiveness:

- The simulation of the real world
- Reflective feedback methodology
- Emotional engagement.

Real-world simulation is the reproduction of financial decision-making scenarios within the safety of a virtual environment. Its effectiveness on learners has demonstrated a deeper and confident understanding of budgeting, debt, savings, and principles of investments. In relation to what we have just mentioned, the authors (Shoeib Hoseiny & Abbas Niknafs, 2020) provide an example: “*Time-bound budgeting scenarios*”. They are based on giving a player responsibility, to allocate limited resources to meet competing needs and foster decision-making skills within realistic constraints. What these simulations motivate is not only the encouragement of strategic planning but the support of experiential learning, which Kolb (1984) identifies as an important driver of adult skill acquisition.

The incorporation of reflective feedback loops into simulations optimizes their learning capacity. In games like Budget Hero and Cashflow Classic, the players learn from post-decision summaries, statistical visualizations, and scenario-specific consequences that make the results of their decisions clear. This aligns with the OECD’s (2014) suggestion that immediate, context-rich feedback be given top priority in financial education tools, further reinforcing appropriate behavior and correcting mistakes in real-time.

The effectiveness of feedback is mainly pronounced when it is granular, in other words, it addresses specific decision points rather than just general performance summaries.

The third pillar, emotional engagement, translated to gamification, refers to scenario-based storytelling. It improves knowledge retention through emotional and narrative depth. Bogost (2005) and additional studies have demonstrated the educational benefits of integrating abstract financial concepts into emotionally compelling stories. From a player’s perspective, they engage in deeper cognitive processing and achieve more lasting learning and educational outcomes when they must confront moral and strategic challenges that reflect the multifaceted nature of the real world. In addition, it has been demonstrated that including

motivation structures such as point systems, competitive multiplayer methods, and progressing levels boosts engagement, especially with younger populations (ING, 2024).

Although all the benefits are noted, the research points out several persistent weaknesses in today's financial literacy games.

First, there is a notable lack of personalization: most games present the same or similar scenarios to players, regardless of their age, socioeconomic status, prior knowledge, or learning goals. According to the research (Zaimovic et al., 2023), it can be determined that a "one-size fits all" strategy carries the risk of alienating students by offering information that is either overly complex, too fundamental, or irrelevant to their actual financial challenges.

Second, many games place more emphasis on teaching historical knowledge than on changing behavior. Few game-based methods evaluate whether players improve their financial behavior (Shoeib Hoseiny & Abbas Niknafs, 2020). The long-term goal of improving financial competence may be compromised if the educational impact is temporarily lacking behavioral feedback.

The lack of sophisticated, conversational interfaces is an additional disadvantage. None of the studied games utilizes voice-activated advice, natural language conversation, or AI-powered coaching to personalize gameplay dynamically. Players lose the opportunity for context-aware explanations that could enhance conceptual understanding and rapidly clear up confusion due to their lack of them. Furthermore, many games are designed for brief academic applications (in the classroom) rather than as resources for continuous skill reinforcement, which means they lack realism and persistent engagement (Shoeib Hoseiny & Abbas Niknafs, 2020).

In conclusion, the literature review is transparent and clear: gaming-based learning is a powerful tool that is underutilized in improving financial literacy. For a game to be considered adequate, it must be capable of simulating real-life financial scenarios, accompanied by feedback, to finally engage learners emotionally. Currently, most of the games available lack depth in personalization, they don't emphasize long-term behavioral change, and fail to harness emerging technologies. There is a visible opportunity for innovation. The proposal is a video game – a GPT-enhanced, voice-guided, scenario-based experience that directly addresses the issues described in the literature.

The video game will combine:

- a. Pedagogical soundness (Kolb, Freire, Self-Determination Theory)
- b. Technological innovation (voice AI, adaptive feedback)

- c. Behavioral realism (emotion, reflection, failure loops)

The empirical and theoretical foundations of this project have been determined via this literature review. Naturally, this led us to the following chapters: "The Implementation of Voice Assistant Personalization into Financial Game Design" and "Analyzing Current Financial Literacy Games: Insights for Voice Assistant Enhanced Design," where five popular games will be examined, along with their advantages, disadvantages, and potential solutions.

2.3 The Implementation of Voice Assistant Personalization into Financial Game Design

A new design paradigm is required to address these gaps, an innovation that integrates emerging technologies such as Generative Pre-trained Transformers (GPT) and voice-based AI assistants to enrich the learning experience. AI can be incorporated into a financial video game to act as a personalized financial coach, capable of adjusting difficulty levels, altering scenarios, and providing conversational insights in response to user input. In this way, AI can function as a personalized financial coach. This reinforces Bogost's (2005) argument that video games have the most significant impact when they operate as emotionally intelligent, dynamic systems, rather than as static educational content delivery mechanisms.

In terms of functionality, a financial literacy game driven by GPT could rapidly retrieve real-world scenarios from a central database, examine player alternatives using a scoring engine, and provide personalized feedback to clarify the immediate result, while also placing it in the context of more general financial principles, by integrating the adaptive and receptive capabilities of AI systems with the educational attributes of simulation, feedback, and storytelling. Such a strategy would create an academic environment with four primary characteristics: realistic, personalized, emotionally persuasive, and capable of motivating long-term behavioral change.

2.4 Analysing Current Financial Literacy Games: Insights for Voice Assistant Enhanced Design.



Fig 2. Beat the Fed game logo.

Beat the Fed

This video game focuses on monetary policy, where the main challenge for players is to manage interest rates to control inflation and unemployment. It simulates real-world central bank decision-making and offers insights into macroeconomic trade-offs. There is a disadvantage for beginners, as this game assumes a baseline understanding of monetary theory, so it is less accessible to them. Regardless of scenarios, they are static, and feedback is not personalized but based on outcome metrics. If AI-driven commentary is implemented, it can transform outcomes into tailored learning experiences, bringing the knowledge gap for less experienced players and making complex policy concepts more understandable.



Fig 3. Timeflow game logo

Timeflow: Sim Money

In this video game, players are responsible for managing their money, employment, and lifestyle decisions over time, using a life-simulation model. The long-term implications of financial decisions are made clear by their dynamic time mechanism. The narrative richness is a significant strength; ordinary learners may find it too complex. With the integration of scenario-specific coaching, voice-based explanations, and difficulty adjustments tailored to player proficiency, AI integration can maintain players' interest without compromising depth. Due to its variety, the game is accessible to both novice and expert players.



Fig 4. Build your business empire game logo.

Building Your Business Empire

This game focuses on entrepreneurial skills, guiding players to build a virtual company. The decision-making process simulates real-world business growth scenarios, reinforcing resource allocation and risk management skills. Moreover, the scope for learning is narrow, focusing more on business mechanics rather than broader personal finance principles. The scenarios lack diversity, which limits their replay value. With the implementation of an AI layer, the game could generate business obstacles related to global market data, increasing realism and broadening educational outcomes.



Fig 5. Cashflow Classic game logo.

Cashflow Classic

This game, created by Robert Kiyosaki, combines instructions on personal finance with board game mechanics. It highlights the approach to teaching passive income development and the balance between assets and obligations. The features of this game keep players engaged and motivated because, at some point, strategies are mastered, and then there is nothing new to continue with. For advanced players, proficiency arrives very fast, and they stop playing the game due to a lack of adjustable difficulty or a change in scenarios. This game can be enhanced with new, context-aware financial events, and AI can contribute by introducing unpredictability, extending the lifespan, and reinforcing the educational foundation.



Fig 6. Budget Hero game logo

Budget Hero

This game is designed for civic education to help balance the US federal budget, while also aligning with individual spending levels. This game demonstrates an excellent level of development in civic and financial awareness among players, as well as effectively tying fiscal policy to social concerns. The main limitation of this game is its temporal relevance, where scenarios rapidly become outdated when budgets change. AI contribution is the use of real-time economic and policy data to automate changes in the scenarios. This would guarantee accuracy and relevance as well as the preservation of its framework for analytical decision-making.

3 Research Methodology

This research adopts a structured and systematic methodology to ensure an organized development and evaluation of the financial literacy video game prototype. The strategy is grounded in recognized academic principles in accordance with the objectives outlined in the literature review. The methodology is based on best practices in educational game design (Gee, 2003; Prensky, 2001) and experimental learning theory (Kolb, 1984). Each of the structures was adapted to suit the scope and available resources for the development of this study, ensuring that the process remained academically robust and practically feasible.

3.1 Procedure

Four primary stages:

- A.- Definition of the problem in the literature review
- B.- Prototype design
- C.- Implementation
- D.- Evaluation

3.2 Tools and equipment

Tools implemented in the technical environment include

- Development environment: Visual Studio Code for code writing
- Technologies implemented: HTML, CSS, JavaScript, LLMs
- Voice Assistance Integration: Automated voice
- Hosting Platform: Google sites
- Testing device: personal laptop
- Browsers: Firefox or Chrome

3.3 Techniques

The primary technique applied for this topic is gamification, including the integration of quizzes, decision-making, and feedback loops in each module with the finality of engaging players. The experimental learning stages are:

- Cash module: Quiz-based interaction + feedback
- Debt module: Decision-making + feedback
- Savings module: Compounding quest + feedback
- Risk of Investment module: Investment quest + feedback

The scenarios present realistic but simplified financial situations that target an audience between 10 and 20 years old, with the vision of being adaptable for future generations, developed in future iterations.

3.4 Evaluation

The decision to use qualitative evaluation is grounded in the iterative process of developing educational and financially focused games where early-stage prototypes are assessed for functionality and pedagogical alignments before conducting quantitative trials (Michael & Chen, 2005). This research, based on qualitative analysis, ensures that subsequent studies can be conducted on a stable and pedagogical academic product, thereby maximizing the validity of future quantitative findings.

4 Design Specification

Four financial literacy video games were deployed in Google Sites; a logical, modular architecture underpins such design. It was implemented using prompt engineering applied to LLMs to generate a single-file code for HTML, CSS, and JavaScript. The single-file code was deployed in Visual Studio Code. Due to implementation limitations, the initially planned GPT-based voice assistant was substituted by built-in browser speech synthesis to welcome, guide, and provide in-depth and coherent feedback.

The architecture is as follows: start screen > main menu (located on the top right)> topic selection (cash, debt, savings, or risk investment) > quiz/decision-making explanation loop > score update > feedback > end. The design model was considered to include an enhanced flow with APIs; in this case, the automated voice works as an accessible alternative.

To maintain engagement, gamification strategies were implemented, such as scenario-based quizzes, voice guidance, instant feedback, and incremental scoring. Iterative learning through gameplay becomes possible through the primary algorithm's quixotic explanation-feedback loop, where player reactions lead to score modifications and situational explanations.

The requirements include the following:

Technical features: browser compatibility, web-based, responsive design.

Educational features: content-based specifically on financial topics (cash management, debt, savings, and risk of investment), adaptive explanations, and assessment of knowledge retention.

User experience: clear instructions, intuitive navigation, audio guidance and feedback, and visual elements suitable for people between 10 and 20 years old. This is merely a foundational prototype model for long-term development, with room to grow into simulation-based gameplay, wider age targeting, and the implementation of an API AI voice assistant system to guide, support, and provide live spoken feedback.

5 Implementation

During the final stage of development, a prototype of a financial literacy video game was created, comprising four separate modules dedicated to key economic concepts, including cash management, debt, savings, and investment risk. The creation of those games was made using single-file code for HTML, CSS, and JS. Google Sites was used to host and deploy each module's code for ease of online access and testing.

The particularity of the modules is to follow quiz explanation feedback or a decision-making scenario with a rapid response; players receive contextual explanations and can view their updated scores. An automated voice assistant is implemented via the browser's speech synthesis, delivering live-time audio feedback that translates to enhanced engagement and accessibility.

The outputs related to this stage are:

- Each financial topic features functional, browser-based gaming modules.
- It contains two fundamental integrations, scoring systems and feedback loops.
- Audio elements and visuals are aligned with an age-appropriate design for users between 10 and 20 years old.

Google Chrome was used for browser testing, and Google Sites was used for deploying code and hosting the games. The use of standard web technologies ensures compatibility across devices, eliminating the need for installation requirements. The prototype's design is purposefully scalable, allowing for future enhancements while preserving its lightweight and accessible structure.

6 Evaluation

This section aims to critically evaluate the functionality, educational value, and potential impact of the financial literacy game prototype. Due to the scope of this project and its emphasis on technical and educational design, the assessment was conducted through self-simulating testing by the researcher. This ensured that cash, debt, savings, and risk of investment modules were systematically reviewed for stability, usability, and pedagogical alignment.

From a testing perspective, the four modules (video games) were successfully loaded and operated within their hosting environment (Google Sites) with the integration of single-file HTML, CSS, and JavaScript code, which was initially deployed in Visual Studio Code. The technical viability is confirmed between the navigation of modules, response handling, and an automated guidance voice.

From an educational perspective, each module has the capacity to convey essential financial literacy concepts.

The following diagram illustrates the operational architecture of the whole game.

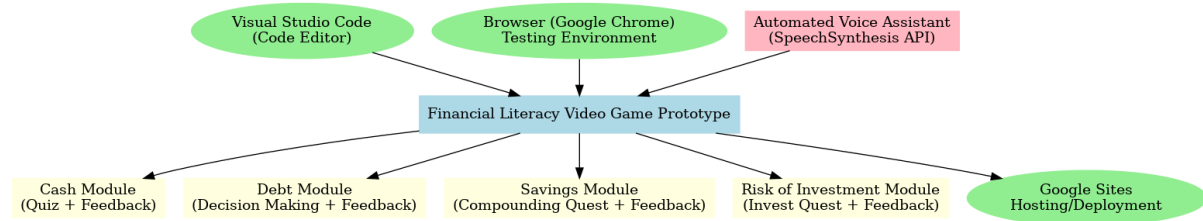


Fig. 7 Implementation and architecture of financial literacy video game.

6.1 Experiment / Cash module

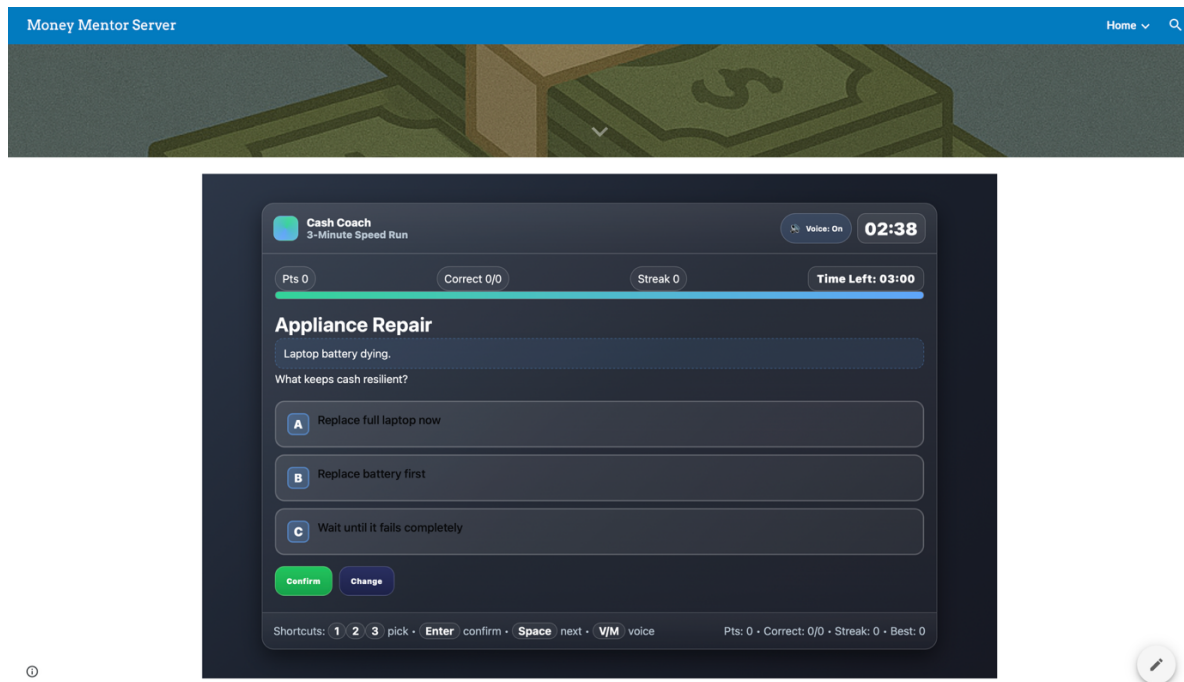


Fig. 8 Features of the cash module and functionalities

6.2 Experiment / Debt module

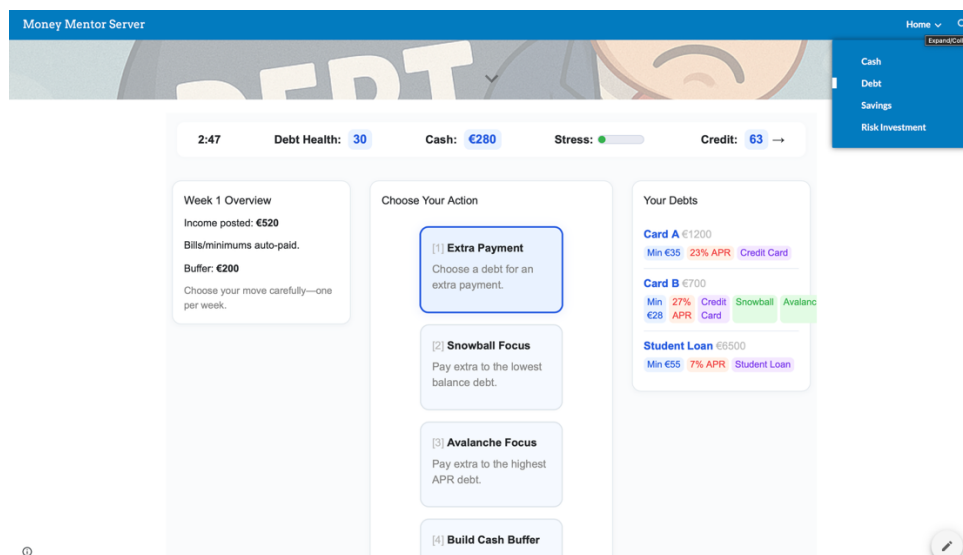


Fig. 9 Features of the debt module and functionalities

6.3 Experiment / Risk Invest module

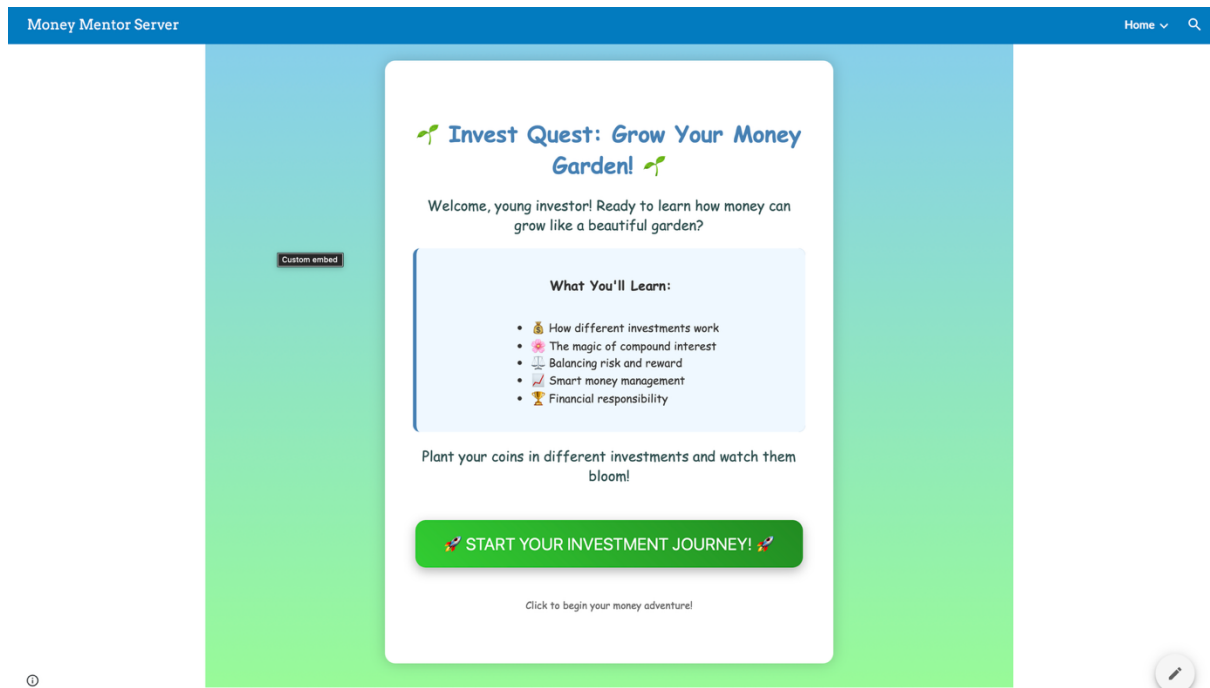


Fig. 10 Features of the Risk Investment module and functionalities

6.4 Experiment / Savings module.

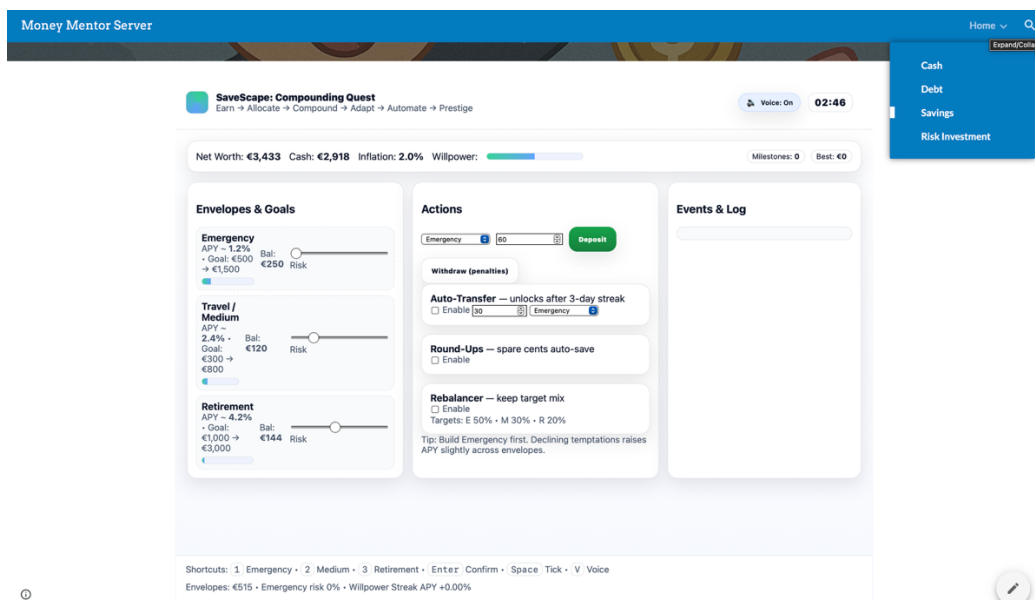


Fig. 11 Features of the savings module and functionalities

6.5 Discussion

The evaluation is based on Experimental Learning Theory (Kolb, 1984), which emphasizes that efficient learning is possible through active engagement, reflection, and application —a concept that API GPT was thought to be useful for. The game facilitated those stages by:

- A. Playing in an environment of realistic scenarios allows the player to make choices (active experimentation).
- B. Giving immediate explanatory feedback to the player (reflective observation).
- C. Repetitive challenges aim to reinforce key concepts (abstract conceptualization).
- D. Application of acquired knowledge in subsequent scenarios (active experimentation).

The research objectives were focused on the creation and functional validation of the prototype. This research project avoids hypothetical data visualisation to maintain methodological clarity and academic integrity. The findings remain tied to the implemented system and its tested performance.

From the writer's point of view, the evaluation confirms that the game is a foundation for future development and scaling. The modular structure serves as a framework for adding advanced features, better scenarios, and higher difficulty levels, while the web-based deployment ensures accessibility. Future developments in this research should benefit from structured user testing, enabling quantitative analysis of improvement and tracking of educational impact.

7 Conclusion and Future Work

From an efficacy perspective, the project met its defined scope and laid a foundation for future development. The absence of user testing represents the main limitation due to the lack of empirical evidence of knowledge collected. The reliance on pre-scripted voice output limited adaptability and depth of interaction with the player compared to an AI-powered conversational system.

Future work should focus on:

- Studies across various age groups to understand engagement, retention, and the application of financial literacy in real-life scenarios.
- Expanding the game with more difficulties applied and multiple scenarios

- Application of AI-driven conversational feedback
- The development of cross-platform versions of iOS or Android to reach the audience
- Pilot deployment will work successfully in partnership with educational organisations or domestic entities, such as the Department of Finance in Ireland.

With all these developments, the prototype can evolve and transition into a market-ready tool for scalable financial literacy education, which must be adaptable to the diversification of cultural and economic environments.

Links to Google Sites.

Link:

<https://sites.google.com/view/money-mentor-server/home>

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