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Where's the Finance?
A Transmedia Storytelling Experience to Involve
Young Adults in Financial Literacy Topics

MASTER DISSERTATION

Lara Constança Oliveira e Castro de Freitas

MASTER IN INTERACTIVE MEDIA DESIGN



UNIVERSIDADE da MADEIRA

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FACULTY OF EXACT SCIENCES AND ENGINEERING

MASTER IN INTERACTIVE MEDIA DESIGN

Where's the Finance?: A Transmedia Storytelling Experience to Involve Young Adults in Financial Literacy Topics

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Resumo

A literacia financeira é inegavelmente uma das competências de vida mais críticas para qualquer jovem adulto. Infelizmente, a maioria das estratégias de ensino convencionais não captam a atenção do público e não os motivam suficientemente. É aqui que a transmedia storytelling surge como uma alternativa poderosa, ao tirar partido de múltiplas plataformas de mídia e narrativas envolventes. A transmedia storytelling envolve os alunos de uma forma mais imersiva e interativa, tomando partido de uma ferramenta poderosa como as histórias, porque ajudam os alunos a se relacionarem com o material num nível pessoal e são mais propensos a lembrar e compreender a informação. Esta pesquisa tem como objetivo testar como a transmedia storytelling pode ser aplicada ao campo da educação financeira. Um projeto transmedia "Where's the Finance?" foi criado com três mídias: um jogo web, um jogo de tabuleiro e uma página de rede social.

Foram realizados dois estudos-piloto para avaliar o efeito do projeto na literacia financeira. O primeiro estudo piloto foi para o jogo web com integração da página de rede social e contou com 25 participantes. O segundo estudo piloto testou a transmedia completa, incluindo todos os três componentes, com uma amostra de 4 participantes. Ambos os estudos aplicaram uma abordagem quantitativa e qualitativa que incorporou entrevistas e questionários sobre conhecimento financeiro e medidas de envolvimento. Os resultados do estudo mostraram que os participantes adquiriram conhecimento e os dados qualitativos indicaram que os participantes estavam envolvidos, inspirados e conectados com a experiência transmedia. As conclusões permitem propor que transmedia storytelling pode tornar-se um instrumento muito eficaz para melhorar a literacia financeira dos jovens adultos.

Palavras-chave: Literacia Financeira · Jovens Adultos · Educação em Entretenimento · Transmedia Storytelling · Jogo de Tabuleiro

Abstract

Financial literacy is undeniably one of the most critical life skills for every young adult. Unfortunately, most conventional teaching strategies do not capture the attention of the audience and do not motivate them sufficiently. This is where transmedia storytelling comes in as a powerful alternative, by leveraging multiple media platforms, and compelling narratives. Transmedia storytelling engages learners in a more immersive and interactive way leveraging a powerful tool such as stories because they help learners relate to the material on a personal level, they are more likely to remember and understand the information. This research aims to test how transmedia storytelling can be applied to the financial education field. A transmedia project "Where's the Finance?" was created with three media: a web game, a board game, and a social media page.

There have been two pilot studies to evaluate the effect of the project on financial literacy. The first pilot study was for the web of the game with the integration of the social media page and consisted of 25 participants. The second pilot study tested the full transmedia including all three components with a sample of 4 participants. Both studies applied a quantitative and qualitative approach which incorporated interviews and surveys on financial knowledge and measures of engagement. The study findings showed that there was knowledge that was gained by participants, and qualitative data indicated that the participants were engaged, inspired, and connected to the transmedia experience. The findings propose that transmedia storytelling can become a very effective instrument for improving the financial literacy of young adults.

Keywords: Financial Literacy · Young Adults · Entertainment Education · Transmedia Storytelling · Board Game

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1 Introduction

Financial literacy is a multidimensional concept crucial to individuals' financial well-being and decision-making with diverse definitions and perspectives emerging in academic discourse [1–4]. In the scope of this work, we consider the *Organization for Economic Cooperation and Development (OECD)* definition for financial literacy as "*possessing the knowledge, skills, motivation, and confidence to apply financial concepts and risks for decision-making across diverse economic contexts: it is a tool to enhance not only one's fiscal well-being but also society's overall economic participation—an essential resource*" [4]. Several studies [3,5,6] characterize financial literacy as an indispensable tool for individuals to traverse today's economic terrain. Individuals with enhanced financial literacy demonstrated a propensity for advantageous monetary actions (e.g., they effectively plan for retirement, clear credit card debts, and make informed investment decisions) [3,5].

However, financial literacy is a complex topic, and many people lack a basic understanding of financial definitions. Moreover, young adults face additional obstacles, as they often lack interest and access to financial education; formal education systems may not adequately cover financial topics, leaving them unprepared for real-world financial decisions [7]. The current educational approaches on this complex topic are supported by traditional mediums such as classroom learning, books [8,9], slides, and websites¹. While these methods are valuable, they often fail to fully engage students, particularly young adults who are increasingly accustomed to digital and interactive forms of media, it can be perceived as monotonous and disconnected from the interactive and multimedia-rich environments that young learners are familiar with. This disconnect can lead to a lack of interest and motivation, making it difficult for these educational methods to effectively convey the importance and applicability of financial literacy. We propose a transmedia storytelling approach as it presents a promising alternative to conventional teaching methods for financial literacy education.

According to Jenkins, the term “Transmedia Storytelling” refers to a process where integral elements of fiction get dispersed systematically across multiple media to create a unified and coordinated entertainment experience [10]. The immersive and engaging nature of transmedia storytelling can potentially facilitate a more comprehensive understanding of financial literacy concepts among young adults, by delivering an interconnected story that approaches financial literacy con-

¹<https://www.todoscontam.pt/>

tent, leveraging expanded audience engagement, the power of immersive storytelling/world-building and interactivity [11, 12].

Motivated by this potential, we designed a transmedia experience called "Where's the Finance?" composed of three distinct but interconnected media channels:

1) "Where's the Finance?: Goldcrest Curse" - The web game is an individual focused educational experience, participants engage in a puzzle game where they must uncover characters representing different financial principles hidden in the map. 2) "Where's the Finance?: @goldens.fromgoldcrest" - The social media, where users see a zoomed image of the web game in the social media post, and need to find objects hidden in the web map to unlock further clues. 3) "Where's the Finance?: The Comeback" - The board game, which involves a collaborative approach to learning, participants engage with a board game containing three types of challenges: question cards, drawing, and forbidden words.

This dissertation reports on the design process and evaluation of the three distinct media composing the transmedia storytelling experience.

In order to understand the potential and caveats of transmedia storytelling in delivering financial education the following research questions guided our work:

- RQ1: *"Does a transmedia storytelling experience contribute to an increase of knowledge of financial literacy topics among young adults?"*;
- RQ2: *"How effective are gamified approaches in increasing financial literacy engagement among young adults, and what specific game elements most significantly impact learning outcomes?"*;
- RQ3: *"How does the use of narrative and storytelling elements in an interactive experience engage young adults on financial literacy topics?"*

To evaluate the effectiveness of this approach, and understand which media had more potential to develop in more detail, we first conducted a pilot study. The key findings from the pilot study were that some participants demonstrated an increase in their knowledge score after engaging with the transmedia experiences.

Both the team-based and individual approaches were effective in engaging participants and fostering learning, suggesting the potential of this approach in delivering financial literacy content. Furthermore, we developed the web game, the board game, and the social media, and used three

iterations to take the prototype to the final version, these iterations were informal and we did not use any specific type of user. After that we refined the prototype according to the suggestions of the participants, changing the user interface, user experience, and also the graphic design. We also conducted two tests (n=25 and n=4) to test the web game and the transmedia experience as a whole. From this evaluation, we collected positive feedback and relevant results indicating an increase in financial knowledge and high levels of engagement.

1.1 Dissertation Context and Contribution

This work was developed under the EGames Research project where I worked in close collaboration with Ana Santos a colleague from the Master in Informatics Engineering, Ana Santos has contributed to the technical implementation of the web game "Where's the Finance?: Goldcrest Curse", while I was responsible for all the conceptual design and development of all media channels.

The research process of this work resulted in the following contributions: 1. The design of transmedia storytelling "Where's the Finance?" 2. The evaluation of "Where's the Finance?".

Different aspects of the work developed under the scope of this dissertation have been published in the following articles:

Art 1 - **Freitas, C.**, Santos, A., Bala, P., Campos, P., Dionisio, M. (2024). Where's the Finance?: A Transmedia Storytelling Experience to Engage Young Adults in Financial Educational Content. International Conference on Interactive Digital Storytelling. https://doi.org/10.1007/978-3-031-78450-7_3 [13]

Art 2 - Santos, A., **Freitas, C.**, Bala, P., Campos, P., Dionisio, M. (2024). Financial Dream-Scape: Puzzle Narrative Games for Financial Education. ACM International Conference on Interactive Media Experiences, 4, 421–425. <https://doi.org/10.1145/3639701.3663647> [14]

1.2 Structure

After introducing the concept and the research questions, the second chapter describes the review of the literature about edutainment and transmedia storytelling for education, collaboration and cooperation in educational games, narrative persuasion and character identification, financial literacy, and interactive media for financial literacy education. Furthermore, it delves into the research

opportunities we concluded from the literature review. Chapter three focuses on the initial research we conducted, such as a workshop and a pilot study to explore social and individual concepts for transmedia storytelling experiences. In the fourth chapter, we present a re-design of the transmedia storytelling experience, touching on the transmedia world, branding, and all details about each of the media. Additionally in this chapter, we present the high-level prototypes for each media, and also the playtests we conducted to gather user feedback and concept validation. In chapter five we explain our evaluations of the web game alone, and the whole transmedia storytelling experience. Chapter six is where our discussion takes place, delving into our research questions; here we also discuss future work and limitations. Finally, in chapter seven we have our conclusion.

2 Literature Review

In this section, we start by analyzing the financial literacy topic, then we outline the potential of using Edutainment and, in particular, a transmedia storytelling approach to deliver educational content. And then, we lay out the current initiatives that leverage the advantages of immersive and interactive media specially designed for financial literacy education. Furthermore, we explore narrative persuasion and character identification, as well as collaboration and cooperation in educational games.

2.1 Edutainment and Transmedia Storytelling for Education

Edutainment, a blend word of "education" and "entertainment", represents a dynamic approach to learning that leverages the engaging elements of entertainment media to deliver educational content [15]. This innovative form of instructional design seeks to bridge the gap between traditional education and learners' evolving needs and preferences in the digital age. The primary objective of edutainment is to make learning more engaging, thereby enhancing retention and understanding of educational content [15]. Edutainment can manifest in various forms, such as video games, interactive simulations, virtual reality experiences, and multimedia content, aiming to make learning more enjoyable, accessible, and effective. By infusing entertainment elements into educational materials, educators and instructional designers aim to captivate the learner's attention and foster a positive attitude toward learning [16]. Additionally, the immersive nature of edutainment allows learners to apply theoretical knowledge in practical scenarios, fostering a deeper understanding of complex concepts. It can be adapted to accommodate different learning styles, catering to the diverse needs of individual students [15]. Some studies have explored the efficacy of edutainment across various educational domains. For example, Lien et al. used edutainment in a museum using smartphone games to engage visitors in interacting with artifacts [17]. Examples like this emphasize the versatility of edutainment in different disciplines and highlight its potential to revolutionize the educational landscape. Another example would be, Loertscher et al. [18] showed that librarians can use transmedia storytelling to engage students in creative activities, this approach benefits students who do not fit traditional ways of learning, preventing them from becoming passive learners or dropping out of school.

Henry Jenkins is considered the father of the term “Transmedia Storytelling”, which is a process where integral elements of fiction get dispersed systematically across multiple media to create a unified and coordinated entertainment experience. Ideally, each medium makes its unique contribution to the unfolding of the story, and this approach allows creators to expand their stories beyond the confines of a single medium and engage with audiences in new ways ².

Connecting edutainment to transmedia, the literature review conducted by González-Martínez et al. [19] analyzed the concept of transmedia in three different meanings: (1) transmedia as an ability or literacy necessary to actively evolve in this movement of participatory culture; (2) transmedia as the product resulting from that sequential jump between different analogical and digital media, conveyed by a narrative; and (3) transmedia as a didactic strategy that explores that narrative that is developed in different means to achieve concrete didactic objectives. In today’s educational setting, traditional methods are evolving, and educators seek innovative techniques to engage students, foster creativity, and enhance learning outcomes [8,9]. In this way, transmedia storytelling may be a response to this search within the educational context offering exciting possibilities to create compelling stories that deliver effective educational messages [19]. In another instance, Bidarra et al. [20] present a prototype for learning English, as a second language, through transmedia storytelling; the study found that the prototype was effective in promoting language learning and that students enjoyed the experience, concluding that transmedia storytelling offers an opportunity for beneficial educational purposes. Finally, we found a study focused on students from a public school in Cartagena, Colombia, with the primary objective of developing a methodology that integrates transmedia storytelling into science, technology, and society topics. To achieve this, the researchers used a qualitative approach, using virtual ethnography to understand how students engage with transmedia narratives. The study found that students produced transmedia stories inspired by science, technology, and society themes; by participating in the creation process, students not only learned content but also developed digital literacy skills and a deeper awareness of the world around them [21].

Despite these encouraging examples showcasing how transmedia storytelling can be a powerful tool, we can not ignore that it might pose its challenges as well as Kwon et al. [22] highlight in their work the limitations of transmedia storytelling in the entertainment and education sectors.

²<https://rb.gy/of5vul>

They identify several limitations of transmedia storytelling, including difficulties in collaboration between different media platforms and failure to consider consumers who might not be interested in more than one media platform.

2.1.1 Collaboration and Cooperation in Educational Games

Expanding on the integration of entertainment and education, educational games stand out as a powerful tool for fostering collaboration and cooperation, one of the reasons that they are so effective is that they get the players to work as a team. We explore the theoretical foundation and empirical research of the concept of working and playing together as applicable to educational games. Cooperative games are games where students must work together, share ideas, and build meaning from one another, people are more likely to learn when they rely on one another, in a game players must work together to accomplish certain goals. Game-Based Learning [23] states that games are good for learning since they provide engaging, motivating experiences, and in the case of collaborative games, the learners get to practice skills, solve problems, and get feedback in a low-risk environment. Gee [24] claims that motivation is a big part of game-based learning and that collaborative games are the most effective. As Barab et al. [25] point out, games can facilitate the social construction of learning and collaborative games can be designed to accommodate learners with a range of needs and abilities. Educational games can incorporate various kinds of collaborative and cooperative learning methods, including the establishment of mutual goals and objectives, the development of cooperative gameplay strategies, peer review and appraisal, and the formation of virtual teams and communities, if utilized correctly, educational game designers can create games that not only facilitate the learning process, but also help to foster important social skills and attitudes [26]. One thing that is great about educational games is the fact that they require collaboration and cooperation. However, if teachers and game designers understand the underlying theory and the empirical evidence that supports it, they can create games that promote substantial amounts of learning, motivation, and social development. The future of educational gaming must take advantage of the collaborative and cooperative aspects of games to make them not only engaging but also able to make a significant impact on learning [27].

2.1.2 Narrative Persuasion and Character Identification

Building on the concepts of edutainment and transmedia storytelling, it is crucial to explore how storytelling or narrative takes characters, plots, and themes beyond being mere aesthetic devices

to being active tools of persuasion that shape audience beliefs, attitudes, and behaviors. Character identification, which is the capacity of the audience to relate to or put themselves in the shoes of a fictional character, is critical to this process. We examine the relationships between narrative persuasion and character identification by focusing on the characters that audiences can be deeply persuaded by, especially in games. "Transportation Theory" [28] provides us with a framework for understanding how an individual becomes more open and responsive to a persuasive message in an immersive narrative, audiences are not spectators of the characters but become integrated into the story world, and characters are of utmost importance in achieving this goal. Character learning is the process that is central to Social Cognitive Theory [29] which is viewed as learning by imitating models both in reality and in fiction. If viewers identify with characters, they will become highly attuned to their emotions, thoughts, and angles on events; in other words more open to the kind of persuasive messaging that narratives foster. Studies indicate that audiences are persuadable through characters they like and identify with. Factors like physical attractiveness, similarity, and positive behaviors can affect likability, for example, Gerrig argues that likable characters are important for generating identification and persuasion [28]. Studies have shown that audiences are more willing to sympathize or connect with characters who remind them of themselves in demographics, beliefs, and life experiences. Transportation into the narrative world (i.e., identification with characters) increases persuasion, as said by Green et al. [30].

Those characters that experience some sort of major personal growth or transformation are often the most convincing, people tend to be attracted to characters that eventually overcome things and succeed. Bandura discusses character modeling and how it can influence the audience's thoughts and conduct [31]. Characters who evoke empathy in audiences can be highly persuasive, empathy can be found in the form of realistic struggles vulnerability, and emotional depth. Zillmann notes the significance of emotional reactions to persuasion, especially when audiences vicariously experience the emotions of characters with whom they identify [32]. Video games are a very interesting way to examine narrative persuasion and character identification, the use of interactive elements, like player choice and customization, can greatly increase the feeling of agency and connection to the characters. Also, being able to control what the characters do makes the audience care more about their fates, many different methods are used to promote character identification, such as customization, which allows players to create their character and feel a greater sense of ownership over that character; backstories and personal quests, which give the character depth and purpose

and make the audience care about the character more; emotional scenes and hardships, which make the audience feel for the character and be able to relate to the character; and interactive storytelling, which lets the player choose what the character does and suffers the consequences for those choices, making the character seem much more alive and reactive [33].

Narrative persuasion and character identification, many times come hand-in-hand and a well-developed character is one of the most effective means of manipulating an audience. Theoretical frameworks and research findings concerning these constructs can aid creators in developing characters that the audience can relate to and be persuaded by. Especially because of the interactive aspect of video games, provides many possibilities for the development of character identification and the use of its persuasive power [34].

2.2 Financial Literacy

Transitioning from the realm of narrative persuasion, we now delve into the domain of financial literacy. Financial literacy is not one-dimensional but consists of a person's knowledge, skills, and attitudes toward financial matters. It is one of the building blocks of personal and societal well-being, yet its complexity has puzzled teachers. This subsection will discuss the intricacies of financial literacy and explore traditional approaches to it.

One of the cognitive aspects of financial literacy is the ability to comprehend financial ideas and terms like budgeting, savings, investing, and debt. That and how to calculate interest rates, how to read financial statements, and how to make good choices with money. Many factors affect the emotional aspect of financial literacy, including fear, greed, and optimism, and these can cloud judgment and cause irrational behavior. The behavioral aspect of financial literacy is the use of knowledge and skills in real-life situations, which includes spending and saving habits, attitudes towards money, and general money management behavior. Some programs, which can be found in schools, universities, community organizations, and even in financial institutions, are meant to give people knowledge of financial concepts and tools. As Carlson [35] states, financial education programs can be an important factor in financial literacy, for people who do not know how to spend their money. Research by Lusardi et al. [36] has shown that financial literacy education can have a positive impact on financial behavior; books and articles can provide information about financial concepts and best practices, while workshops and seminars can offer a structured learning environment where individuals can learn about financial concepts and ask questions.

Some hands-on financial simulations or role-playing would be a good way to learn these themes. The benefits of experiential learning on financial literacy as well as decision-making abilities can be found in an article by Marriott et al. [37]. Mentoring, perhaps individual or group mentoring would be beneficial to those who are willing to take the time and effort to learn more about personal finance. A thesis by Hocutt [38] found that financial mentoring can have a positive impact on financial outcomes.

2.2.1 Interactive Media for Financial Literacy Education

In this section, we delve into using different formats of interactive media such as games and board games, that focus on improving financial understanding and competence.

Financial literacy plays a crucial role in empowering individuals to make informed financial decisions and researchers have explored various strategies to enhance financial literacy, from innovative technologies to engaging games. To better understand how financial literacy is being explored in the game industry, we played and reviewed 24 games. From this, we analyzed games like “Money Lessons”³, and “Money Wise”⁴, both leverage interactive interfaces, providing comprehensive overviews of personal finance. However, these games do not teach how to apply these concepts in real life, and the long-term investment in playing is hard. Other challenges arise with certain games, such as “Rat Race 2”⁵, where complexity might restrain accessibility, particularly for younger players. Furthermore, the digital transformation of board games, as seen in “Time Flow”⁶, introduces new challenges, potentially compromising the tactile experiences that traditional board games offer. The issue of specificity comes with games like “Credit Clash”⁷ and “Cashflow”⁸. While “Credit Clash” focuses solely on credit-related topics, potentially limiting its scope, “Cashflow” caters to a very specific audience interested in making investments and escaping the rat race, a balance between specificity and broader educational scope is vital for the effectiveness of financial literacy games on a global scale.

The concept of edutainment, a blend of education and entertainment, has proven effective in making learning more engaging and enjoyable. This approach is particularly relevant to financial

³Brightchamps, Money Lessons

⁴<https://play.google.com/store/apps/details?id=com.DotDotFireLimited.TheNeighborMoodhl=>

⁵<https://play.google.com/store/apps/details?id=com.kidapps.ratrace2>

⁶<https://rb.gy/bu7rzh>

⁷<https://creditclash.com/>

⁸<https://www.richdad.com/products/cashflow-classic>

literacy education through interactive media. By transforming traditional financial concepts into fun and interactive experiences, these games embody the essence of edutainment.

In the research field, Klontz et al. [39] explored the impact of an interactive multimedia program that used an animated teen story, text and graphic overlays, interactive exercises, and supplemental printouts to deliver instructions on financial competence among at-risk youth. The study aimed to enhance financial literacy through psychoeducational interventions; their results indicated that this approach had positive effects, contributing to improved financial understanding and competence.

Another research initiative by Kuchciak et al. [40] showed the importance of leveraging social media as an attractive and modern channel for promoting financial literacy. Their study focused on the role of social media in improving financial education among bank customers, their findings report that the number of videos published on YouTube is comparable to the number of posts on Facebook. Another example is "Next Gen Personal Finance" which has several web games about many financial topics ⁹.

All in all, although incorporating technologies and fun games has proven beneficial, for financial literacy improvement there are obstacles and restrictions. The intricacy of these approaches might restrain access and educational benefits. Additionally, the change to the digital environment presents both advantages and possible drawbacks in balancing contemporary gaming experiences. It is crucial to keep exploring and adjusting these techniques to optimize the impact of financial literacy initiatives.

2.3 Research Opportunities

While transmedia experiences and games are abundantly available, in the research field of trans-media storytelling experiences, the financial aspect remains a pertinent concern, as not many experiences delve into the financial literacy topic. While some of the financial literacy games mentioned above show potential, we found a shortage of compelling storytelling games or board games for young adults, which further highlights an untouched potential for immersive and intellectually stimulating experiences in the gaming realm. Another aspect would be the adaptation of the contents to the country's specific rules, also applying the concepts in day-to-day experiences, in our game, we want to show real-life events and how to behave in those, and many of the experiences, are

⁹<https://www.ngpf.org>

individual. Furthermore, with financial literacy being such a complex and multilayered topic [7], we propose that it is a topic better suited to be disseminated across multiple platforms using transmedia storytelling. These observations open up a lot of research opportunities to explore and address these gaps in the gaming industry as well as the research field, fostering the development of transmedia experiences that are not only financially inclusive but also rich in narrative depth, thereby enhancing the overall entertainment and educational landscape for young adults. Hence, in this research, we aim to delve into uncovering what are the potential benefits and shortcomings of using transmedia storytelling as a dynamic and innovative approach to financial literacy education for young adults.

Drawing on the literature that was reviewed in detail several important conclusions were arrived at concerning the existing level of financial literacy education and the new possibilities offered by transmedia storytelling, and edutainment. Outdated methods of financial literacy education may lay the groundwork for financial literacy, however, they do not cater to the needs of young adults because they are boring and non-interactive.

The review addressed the shortcomings of traditional teaching methods as well as the possible advantages that can come from edutainment and transmedia storytelling. The goal of edutainment is to blend education and fun in a way that is sustainable and addresses people's varying styles of learning. Transmedia storytelling, as Henry Jenkins posits, involves the dissemination of story components through various media to better integrate the features and elements of the plot to improve interest and memory of learning materials.

Given these observations, it became clear that there is a need to explore how transmedia storytelling and gamified experiences can improve financial literacy education by making it more engaging and effective. Thus, the following research questions were formulated to address these gaps and opportunities:

- RQ1: *"Does a transmedia storytelling experience contribute to an increase of knowledge of financial literacy topics among young adults?"*;
- RQ2: *"How effective are gamified approaches in increasing financial literacy engagement among young adults, and what specific game elements most significantly impact learning outcomes?"*;
- RQ3: *"How does the use of narrative and storytelling elements in an interactive experience engage young adults on financial literacy topics?"*

3 Initial Research

In this section, we present our initial research; we started by conducting a workshop with students to learn what financial topics they had more difficulty with and curiosity so that we could apply that to our prototype. After that we wanted to analyze which media were more suitable to disseminate the financial topic, to do this we created two different low-fidelity prototypes and tested them with a small group of participants. In this dissertation, we followed research through design methodology [41], which is an approach that involves using design practice as a method of exploration; rather than relying solely on traditional methods like surveys or experiments, it embraces the process of designing as a way to generate knowledge.

3.1 Workshop

We decided to conduct a workshop to map the current necessities and challenges that financial literacy poses to young adults. We opted for a workshop format with students to identify their difficulties and curiosities regarding financial topics because workshops are highly interactive and engaging, allowing for real-time clarification and a deeper understanding of complex issues. This method encourages brainstorming and collaboration, leading to diverse ideas and insights that would be difficult to capture through surveys or questionnaires. Additionally, the group dynamic of a workshop enables us to observe non-verbal cues and group interactions, providing a richer and more nuanced understanding of the students' needs. All in all, together with the target audience we could work collaboratively to identify and prioritize the most problematic themes and challenges within financial literacy.

3.1.1 Protocol, Metrics, and Sample

Students were recruited as part of a class of Informatics Engineering Bachelor and added to a Discord server. First, they were asked to track their finances for 1 week, to explore and critically examine their own financial behaviors, decisions, and experiences. This self-reflective process can help identify patterns, biases, and areas for improvement, ultimately contributing to a more comprehensive understanding of financial literacy and behavior. After this, students were asked to upload their ethnography data, which is tracking expenses, to a Miro Board. The use of this platform is used because it is easier to document rather than using paper, and also easier to access and analyze. Another reason why we used Miro is that participants could collaborate in real time

and read what the rest of them were writing. The Miro boards were previously organized into four groups, in each group we created one square for the autoethnographies and three squares for each sub-group (Sub-group 1 hierarchy, and Sub-group 1 conclusion). For the hierarchy square on the left side, we put post-it notes for them to create the hierarchy, and on the right side, we added a placeholder for them to create a persona with its goals, education, observations, difficulties, problems, and solutions. Finally, on the third square, we had some final questions for them to answer: "In your opinion, what are the barriers to the created solution?", "How can the previously created solution be applied in a general way?", "How would you use the previously developed solution using new technologies?". For more details on the protocol for this workshop consult Appendix A.

During the workshop, we encouraged participants to brainstorm potential solutions, strategies, and interventions to address the identified problems. We also encouraged collaboration and co-creation among participants to tap into their collective knowledge and experience. Figures 1 and 2 show an example of Group 1 and Group 2 registries in the Miro board and the participants engaging in the workshop.

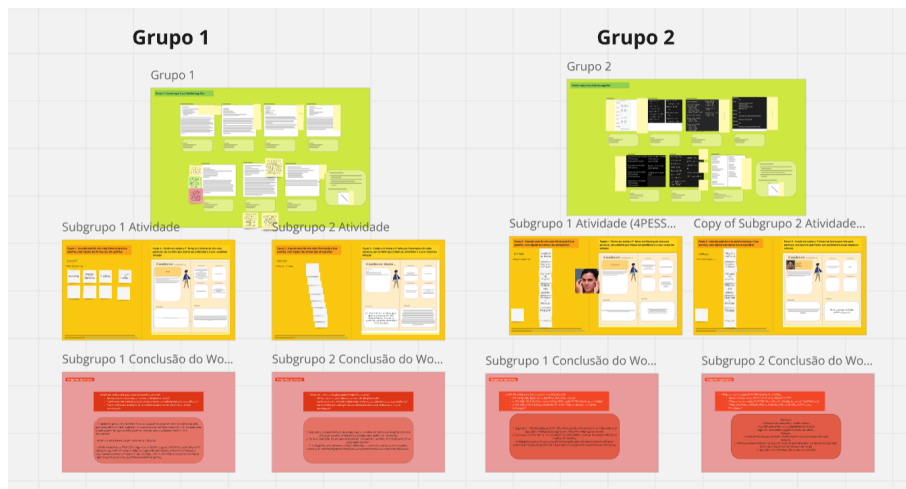


Figure. 1: Example of Group 1 and Group 2 final registry on the miro board for the workshop

Students were divided into 2 groups and asked to join a session on campus. The workshop started with a researcher showing the Miro visuals, and then we had some questions about their autoethnography that were discussed. Some of the questions were, "Did you have any difficulties in tracking expenses and/or budget planning?", "Did any financial topics arise?", "Was there any



Figure. 2: Image taken during the workshop with group 2, the faces of the participants were blurred to maintain anonymity

financial topic that caused any type of stress/anxiety? Which?", "What conclusion were you able to draw from this tracking?".

After that, we asked them to create a hierarchy to better understand what is more important/concerning/difficult when doing their ethnography. The groups were then divided, into sub-groups of four or three, to facilitate the distribution of tasks and to collect the data. Then they were asked to create a persona, which are fictional characters, based upon research to represent the different user types that might use our prototype, it helps us understand users' needs, experiences, behaviors, and goals, and how to design a solution for the near future [42]. That persona was created taking into consideration the hierarchy chosen, it could be someone to represent themselves or who they would like to be, even though they had creative freedom. After creating the persona each group collaborated among themselves to develop a scenario where they explained the problem chosen, taking into consideration the previous theme selected based on the hierarchy, and developed a solution for it. Once the scenario was created each group was requested to present the idea, containing the persona, scenario, problem, and solution, and explain why and how that result was achieved. After that, in the groups that still had time remaining, we had the participants write the answers to the final questions, if not we discussed the questions in groups out loud.

We used a presentation, TV, recording software, note-taking software (Miro), and consent forms. When the session was concluded we transcribed the audio and used Taguette and Excel to organize the data.

Our participants were Master's students at the University of Madeira, in total, they were 25, two being women, and their ages ranged from 20 to 39 years old. The students were divided into four groups and the duration of each session was one hour.

3.1.2 Results

We grouped our data around the main topics we discussed with the participants, with the use of Taguette [?], a text tagging tool for qualitative data analysis.

Auto-ethnographies Forgetfulness: Regarding the auto-ethnographies 21 of the participants found that their biggest difficulty was registering the expenses, the main reason for this was forgetfulness, some quotes to exemplify are *"Remembering to register all expenses of the day"* (P2), *"Pay attention and remember to record all the expenses you had made during the day"* (P3), *"The biggest difficulty when carrying out the autoethnography was remembering to point out the expenses, as well as remembering what the expenses were"* (P4), *"The biggest difficulty may have been keeping track of my expenses"* (P5), *"Throughout the day, it was not always possible to record expenses made with physical money at the time"* (P6).

Discussion: When creating the hierarchy the topic of savings and budgets was mentioned 25 times, some examples are, *"I think that we should separate the savings from the emergency fund"* (P5) and *"Yes okay, we put savings first, and that in second"* (P3), so we can confirm that savings were the priority of the participants. The topic of debts and debt management was mentioned 12 times. The topic of investment was mentioned 7 times. This hints that these topics were not as important or in the foreground as the topic of savings.

Personas: Different personas have different financial difficulties and also aim to attain different goals. For instance, Joaquina's goal is to relocate and obtain her own house while Joaquim Mendez, hopes to perfect his command of the English language. For the personas involved, the level of education ranges anywhere from secondary education to higher education. Several profiles highlight difficulties with managing expenses, saving money, and paying off debts. Employment status and the insecurity of employment are very important for the financial well-being of an individual, for

instance, Joel Maria suffers from an unstable income as a result of semi-employment plus high demand for living expenses. This data brings into perspective the diverse challenges and needs that individuals have concerning being financially literate and advancing in other aspects of their personal development.

3.1.3 Discussion

Due to the results we previously gathered, we can speculate that the participants did not have enough financial literacy to refer to real topics directly because they mentioned food, basic expenses, and drinks instead of real topics such as budgeting, debt, credits, and saving plans.

21 of the 25 participants were under 25 years old and lived with their parents but none of the participants referred the family once. This is important because 21 of the 25 participants do not have a job, so their income is given by the family and they never mention it. With this workshop, we were able to analyze the topics that our target audience did not know about or wanted to know more about, most participants agreed that savings/budgeting was at the top of their hierarchy, and the second most important topic was debts being mentioned 12 times. So for our prototype, we decided to focus on the topics of savings and debts.

3.2 Pilot Study: Exploring Collaborative and Individualistic Concepts for Transmedia Storytelling Experiences

¹⁰ In this section, we delve into the pilot study of the two concepts we created. The first one is a collaborative approach called "Financial Frenzy" composed of a board game, a social media page, and a mobile application; and the second one is an individual experience called "Where's the Finance?" composed of a web game, a coloring book, and a social media page. These concepts were born from the previous workshop which concluded that the participants did not have financial literacy but had an interest to learn about it more dynamically and interactively.

We chose to test the two concepts to examine the possibilities of an individual vs. social component, given the limited data on which media best fits the approach to financial literacy concepts.

3.2.1 Concept A - "Financial Frenzy"

This experience is distributed through three main channels:

¹⁰The text in this subsection has been published with the name "Where's the Finance?: A Transmedia Storytelling Experience to Engage Young Adults in Financial Educational Content"

1. "Financial Frenzy" (see fig. 3) – a board game designed to teach financial literacy concepts such as debt and savings;
2. "FitFrenzy" – a mobile application designed to train financial concepts, and supposed to be played after the board game;
3. "@goldensfromGoldcrest" – a social media profile that engages users by fostering discussion and communication about relevant topics.

Given our desire to explore social and individual concepts in transmedia storytelling, we describe (and evaluate) only *Financial Frenzy* as it involves competitive and collaborative social elements to promote conversation about financial struggles and experiences. Players are divided into two teams and aim to reach the end of the board by completing challenges determined by two dice, one for movement and one for the type of challenge. The challenges include:

- *Question Cards*: Multiple-choice questions to test financial knowledge.
- *Drawing Challenges*: Players draw financial concepts for teammates to guess, promoting understanding of abstract ideas.
- *Forbidden Words Challenges*: Players describe financial terms without using specific words, encouraging creative thinking and discussion.
- *Memory Game (Optional Challenge)*: Can be played when trying to answer the question card, offering additional educational content. The content of the cards are definitions related to the topics on the question cards (red for debt, yellow for savings); this was designed to be an alternative method for those who wished to know more about financial literacy topics.

3.2.2 Concept B - "Where's the Finance?"

The transmedia channels for this experience are:

1. "Where's the Finance?" (see fig. 4) – a web game where the player explores financial narratives;
2. "Relaxing with the Goldens" – a coloring book linked to the web game;
3. "@goldensfromGoldcrest" – a social media page, similar to the one previously mentioned.

For concept B, we wanted to explore delivering financial literacy content as individual experiences, focused on introspection and reflection. *Where's the Finance?* is a web-based game designed

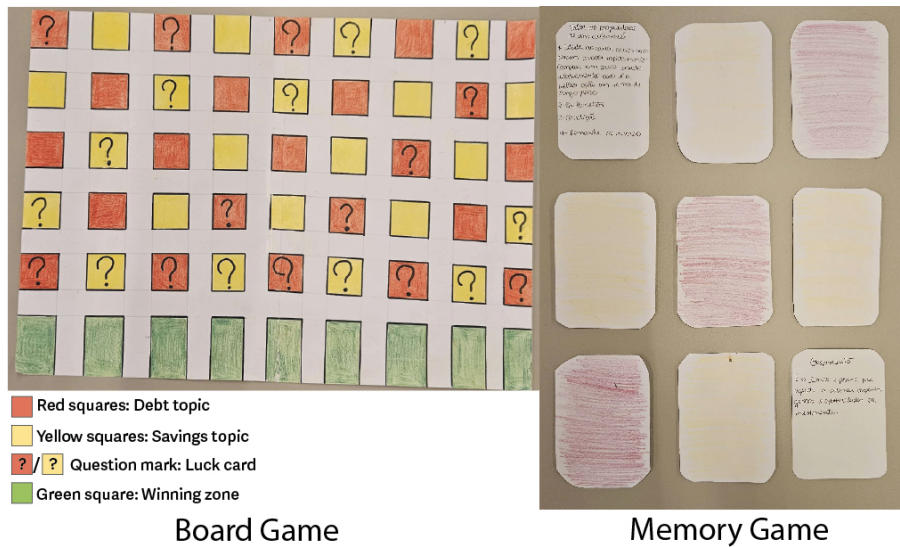


Figure. 3: Low-fidelity prototype for "Financial Frenzy". On the left is the boardgame, and on the right is the memory game.

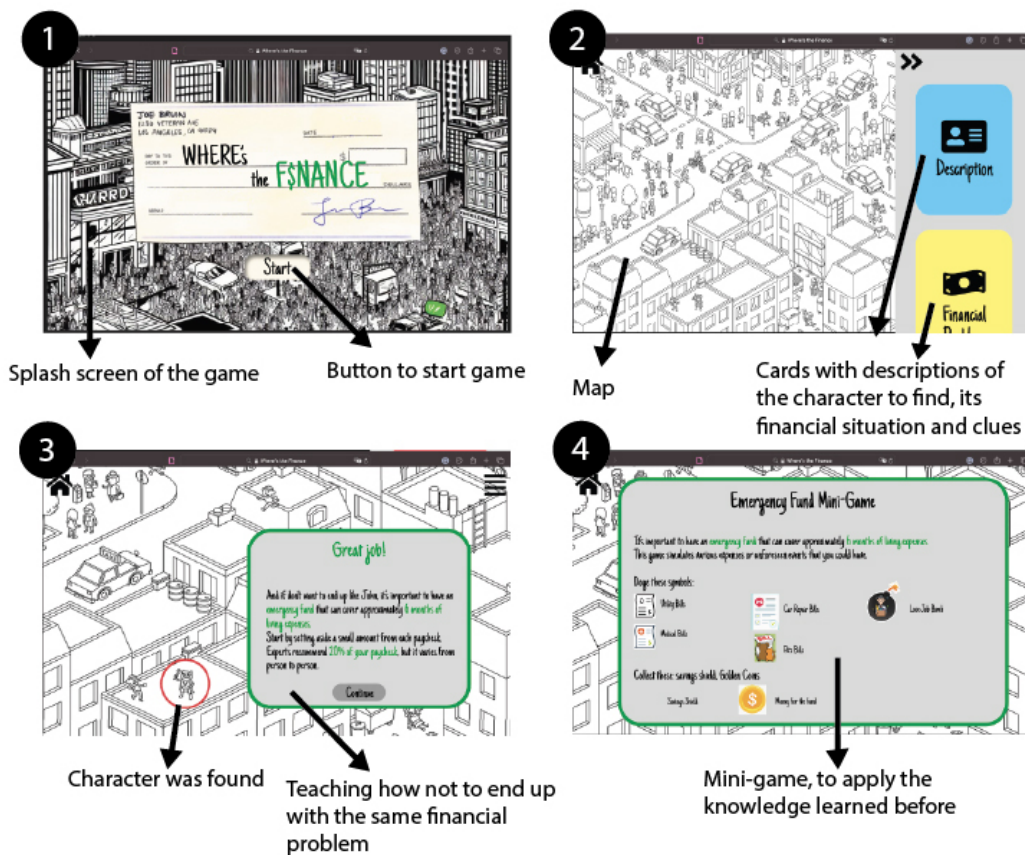


Figure. 4: Where's the Finance is a single-player game where players explore a map to find characters while learning about their financial problems: 1) game's start screen; 2) the map and cards with character's description (blue) and financial problem (yellow); 3) when the character is found, a popup informs the player about the financial problem, 4) the mini-game to apply learnt knowledge.

to be an individual experience where players assume the role of financial detectives tasked with identifying and addressing financial challenges faced by characters. Players progress by finding characters on a map; to help the players, detailed descriptions of characters and their financial challenges are presented in envelopes and cards, covering issues such as budgeting dilemmas and investment decisions. After finding the character, the users play a mini-game with a lesson addressing the financial problem, related to the financial challenge of the character, providing players with a hands-on application of financial knowledge.

3.2.3 Financial Topics

It is important to highlight the rationale behind the choice of educational content. For the choice of the financial literacy themes, we took into consideration the themes that were more times mentioned in the workshop, as we can see in Sub-section 3.1, that are savings and debt. Additionally, we took into consideration several articles such as a study by Solheim et al. [43], which explores college students' narratives about financial socialization experiences within their families; key findings showed that "*the three most prevalent themes about what and how students learned about finances are reported: saving, money management practices, and family communication patterns*". Another study by Webley et al. [44] examined the economic socialization of young adults in Europe, highlighting how savings and budgeting are essential for young adults' financial health. Additionally, a study by Totenhagen et al. [45] states that the US Department of the Treasury argues that a successful program should focus on basic savings, credit management, home ownership, and retirement planning. Finally, empirical evidence supports the importance of budgeting and saving across all developmental periods, from preschool-aged youth [46] to college-aged young adults [47]. Taking this literature and the workshop conducted, into consideration, we decided to focus mostly on savings and expenses/debt, since these are the most important and basic concepts that young adults should know about.

3.2.4 Protocol and Metrics

We sought initial feedback on the two game concepts to assess their effectiveness in teaching financial literacy and players' perceptions. For this pilot evaluation, we chose low-fidelity prototypes of elements of each transmedia storytelling experience (the physical gameboard of concept A and a digital prototype, in Figma, of the web game in concept B) and conducted a counterbalanced within-subject evaluation.

Participants (n=8) were recruited through convenience sampling (using a University Discord server) to participate in a playtest that took place in our research center. Participant's ages ranged between 18 to 30 years old; 62.5% were female, all students, and all familiar with games. The session started with the researcher explaining the protocol and collecting consent. Prior to the use of the prototype, participants filled out a questionnaire with demographic data and financial literacy multiple-choice questions and were explained the rules for each game. Based on financial definitions from a financial website [?] and the content in the games, seven financial literacy multiple choice questions were used (e.g. "*What is an emergency fund?*", "*What is an emergency fund for?*", "*To create an emergency fund, being able to create a budget is extremely important*", "*It is always a good idea to put a portion of your salary into savings*", "*How long should the emergency fund cover?*", "*What are the three types of expenses in a budget?*", etc.).

The order of games A and B was counterbalanced. For game B, participants played individually; for game A, P1-P4 and P5-P8 played as groups. After the first game, participants repeated the questionnaire with financial literacy questions.

After each game, participants filled out a questionnaire with the Game Experience Questionnaire (GEQ) [48] and responded to some open-ended questions by the researcher; audio was recorded and later transcribed. The GEQ comprises 4 modules, measuring various components (from 0 to 4) like *Flow*, *Competence*, etc. For both games, we used the In-Game and the post-game module; for game A, since we have a social aspect, we additionally used the Social Presence module. Quantitative results were analyzed using R. Due to the small number of participants and the pilot nature of the evaluation, we did not seek statistical methods.

3.2.5 Results

After analyzing the data collected, we summarized results from the GEQ [48] into table 1 (means and standard deviations) and fig. 5 (boxplot distributions).

The results from Concept B show promising outcomes. Most participants rated high in *Competence* and *Positive Affect* (with a mean of 3 and 3.38, respectively). In the *Challenge* dimension, only two participants gave high scores (above 3), indicating a need for increased difficulty in a future redesign. Low scores in *Negative Affect* and *Negative Experience* were consistent with high *Positive Affect* and *Positive Experience* ratings.

For Concept A, participants also reported high scores in Competence (mean of 3.06). In the *Challenge* dimension, scores indicate a perceived challenge. Low values in *Negative Affect* and *Negative Experience* aligned with high *Positive Affect* and *Positive Experience* ratings. Additionally, Social Presence (see fig. 6) dimensions were also adequately distributed.

Overall, Concept A and Concept B scored similar values in terms of game experience. Due to the repetition of content in Concepts A and B, financial literacy questions were only evaluated for the first game played. The accuracy of users' responses improved after participating in the experiences, as shown in Figure 7.

Module	Component	Concept A	Concept B
In-Game	<i>Competence</i>	3.00 ± 0.53	3.06 ± 0.62
	<i>Sensory & Imaginative Immersion</i>	1.44 ± 0.32	2.75 ± 0.71
	<i>Flow</i>	2.81 ± 1.44	2.25 ± 0.85
	<i>Tension</i>	0.31 ± 0.37	0.25 ± 0.38
	<i>Challenge</i>	2.56 ± 0.56	2.06 ± 0.90
	<i>Negative Affect</i>	0.31 ± 0.46	0.50 ± 0.53
	<i>Positive Affect</i>	3.38 ± 0.95	3.00 ± 0.76
Social Presence	<i>Empathy</i>	3.27 ± 0.97	–
	<i>Negative Feeling</i>	1.27 ± 0.72	–
	<i>Behavioural Involvement</i>	2.52 ± 1.30	–
Post-game	<i>Positive Experience</i>	2.88 ± 0.87	2.62 ± 0.83
	<i>Negative Experience</i>	0.25 ± 0.28	0.23 ± 0.25
	<i>Tiredness</i>	0.69 ± 0.65	0.69 ± 0.59
	<i>Returning to Reality</i>	1.04 ± 0.97	1.04 ± 0.68

Table 1: Mean and standard deviations for GEQ components for Concept A (n=8) and Concept B (n=8)

We grouped the participant's reflections and ideas, collected during gameplay and the open-ended questions into categories for each game. For Concept A, the board game, we grouped the quotes into the following four categories:

- **Memory Cards:** We understood that the players who were not familiar with a certain financial literacy concept needed further aid (P2 "*It would be good to have an explanation on the cards, for example, a financial consultant is very specific*"), so they suggested adding in all cards a small explanation of the concepts. Participants emphasized the importance of clarity in memory cards by suggesting color removal (P1 "*Remove the colors from the memory cards, because it helps to know which one it is*") and adding explanatory details.

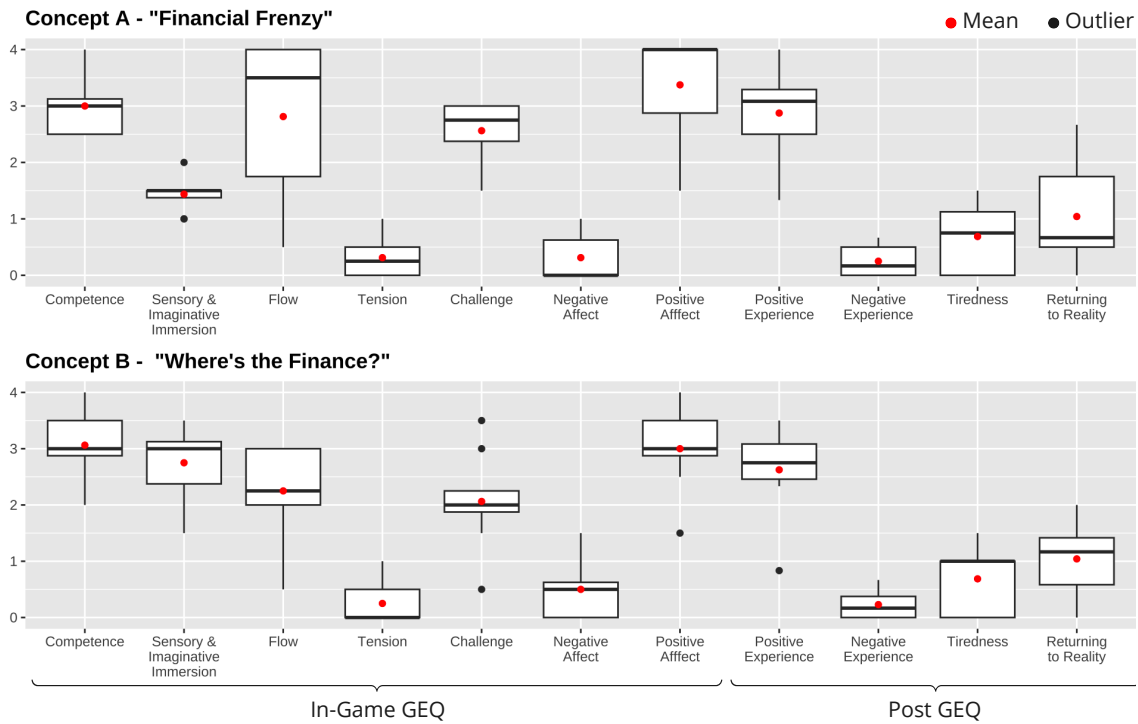


Figure 5: Boxplot distributions for In-game and Post-game GEQ components for Concept A (n=8) and B (n=8)

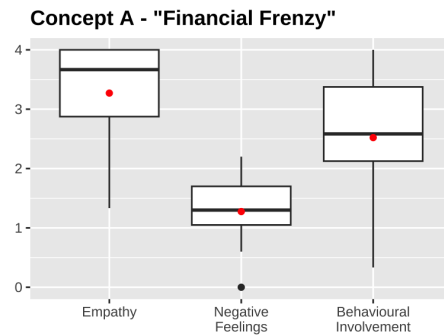


Figure 6: Boxplot distributions for Social Presence GEQ component for Concept A (n=8)

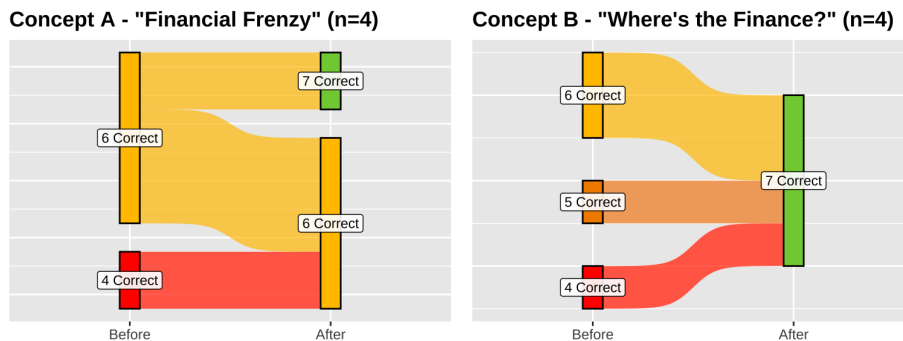


Figure 7: Alluvial diagram showing correct answers in FL questionnaire, before and after Concept A (n=4) and B (n=4).

- **Media Expansion:** Participants wanted to expand the story world in other media; some suggested the creation of an app to complement the game (P4: "*There could be an app, and it would give prizes throughout the game*").
- **Engagement:** Participants showed positive engagement and discussion of these complex topics with the peers they were playing with (P4 "*It is more fun to play in teams and I liked the mini-games*"); they emphasized the importance of dynamic features (P3 "*I liked the forbidden words cards, it made the game more dynamic*") to keep players engaged and not an overwhelming amount of information.
- **Game suggestions:** With the participants' feedback, we understood that players who tested Concept B first, wanted to apply the knowledge gained from the previous phase and test their knowledge to see if they were able to retain the information, and they also had some suggestions for improvements and new games (P3: "*Hangman game, could be another game*").

Likewise, for Concept B, the web game, we grouped the quotes into the following four categories:

- **Money incentives:** Participants felt the need to apply for the money more directly and learn how to manage it (P1 "*There could be money, to apply what they learned*", P4 "*There could be money like monopoly*"). Participants suggested incorporating financial incentives and diversifying gameplay with activities or apps.
- **Links:** Participants wanted to personalize the content and discover more about the financial topics. They suggested the presentation of links to explore the topics further (P6 "*Have a section where you have everything you learned with links, that you could go back to*").
- **Engagement:** Participants showed positive engagement (P6 "*I think the web game is more fun*") and some reflection on their own financial doubts (P8 "*The mini-games seemed like an achievement, like now that you know this apply the information you learned*"); they emphasized the importance of dynamic features to keep players engaged, and not a lot of information at the same time making the user less confused (P8 "*I found it cool that there was not a lot of information, it is interesting.*").
- **Game suggestions:** With the participants' feedback, we understood that they wanted to apply what they learned on the journey of the characters and make sure they learned the financial concepts, and also had some suggestions for improvements, like creating a happiness

meter for the town (P6 "*There could be a happiness meter for the town*") or even see how the passage of time would affect the economy (P3 "*There could be a part of the game where the time would pass and the players would see the results of that time on their financial assets*"). We could see interest in long-term gameplay (P6 "*I would have liked to see what happens in the long run when making a financial decision*") and investment in new game mechanics (P4 "*The screen could be split, one side we could do things, and the other side could be the results*").

3.2.6 Discussion

Through our pilot study, we were able to evaluate the potential effectiveness of using different game approaches, specifically web-based and board games, in enhancing financial literacy. Similarly to what Webley et al. [44] reported, in our pilot study, users also showed some difficulties on essential topics for young adults' financial health, such as savings and budgeting, more specifically, debts. It was evident that even when participants had some understanding of the broader topics we were trying to teach, they lacked the fundamental skills needed to execute these concepts effectively. Seeing some of the participants struggling with basic concepts of financial literacy but at the same time engaged with both games gave us even more assurance to continue the pursuit of improving our transmedia storytelling experience. In particular, it was interesting to see that while we did not test the whole transmedia and just focused on the games, it was the participants who hinted at this need for more types of media that would expand the experience. Participants suggested having a complementary mobile application to the board game and in the web game to be able to follow up with further information regarding some of the topics presented. Additionally, the participants showed the need for long-term gameplay to understand how the economy and their financial decisions would affect the story world (and how this would translate into an impact on their lives).

Our pilot study showed that both games had potential in different aspects. For example, we saw that, similarly to what Boghian et al. [49] reported, the board game had a strong social and engaging component with the potential to address educational topics such as financial literacy. This opens up the possibility for participants to discuss financial literacy in a light and relaxed way and, in this way, counteracting the tendency of financial literacy being a taboo topic [50, 51]. On the other hand, we saw that the web game since it's a more individualized experience, allows

participants to delve into the financial literacy concepts in more depth and have the potential for more financial literacy knowledge acquisition.

Therefore, since both games presented potential that we considered essential for impacting financial literacy, we decided to incorporate both web game and board game into a single transmedia storytelling experience. We opted to keep the title and overall narrative as the one from "Where's the Finance?" as this story world had more transmedia potential due to its characters and their stories. Considering the observed findings, over the next chapter, we present a re-design proposal for our transmedia storytelling experience that represents a union of knowledge and experimentation.

4 Where's the Finance Transmedia

In this section we explain the transmedia world, how it is structured, and how much media it encompasses. We also explain the branding of the experience; and focus on each of the media separately touching on topics such as narrative and characters, design rationale, gameplay mechanics, user interface and user experience, and the high-level prototype. Additionally, we discuss our user experience test and the refinements that came from it.

4.1 Transmedia World

The transmedia experience is based on a fictional mystical story world named "Goldcrest". In this world, a community of people known as the "Goldens" are under a horrific curse. Legend had it that a curse was cast upon their land and was turning many of its townfolks into horrific creatures. Its storytelling curve is not just developed to draw users into an engaging story but also as a creative medium to spread financial literacy.

This experience is structured across three different media platforms, the "Where's the Finance: Goldcrest Curse", the "Where's the Finance: The Comeback", and the "Where's the Finance: @goldens.fromgoldcrest", each uniquely contributing to the development of the storyline and educational goals. It is purposely designed to lead users through an ideal sequence of engagement with these media to allow a progressive learning curve, Figure 8 illustrates the three media. A fourth media also exists, yet this component is out of the scope of the dissertation, and for more information it is possible to read the article by Santos et al. [14].

By playing the web game first, people are introduced to the main characters and the narrative context within a controlled, self-paced, individual setting, permitting introductory exposure to the core concepts of financial literacy. The transition to Instagram turns users back to their real-world experiences, further emphasizing that financial literacy is not contained simply in the isolated environment of the game but is a day-to-day life skill. Finally, the board game acts as a summary and expansion of the knowledge where the users can use what they know regarding the topic in a collaborative scenario, hence enforcing both retention and application of financial concepts. By following this order, the experience hopes to both teach and involve interested people in fully immersive ways and representative of relevant financial topics.

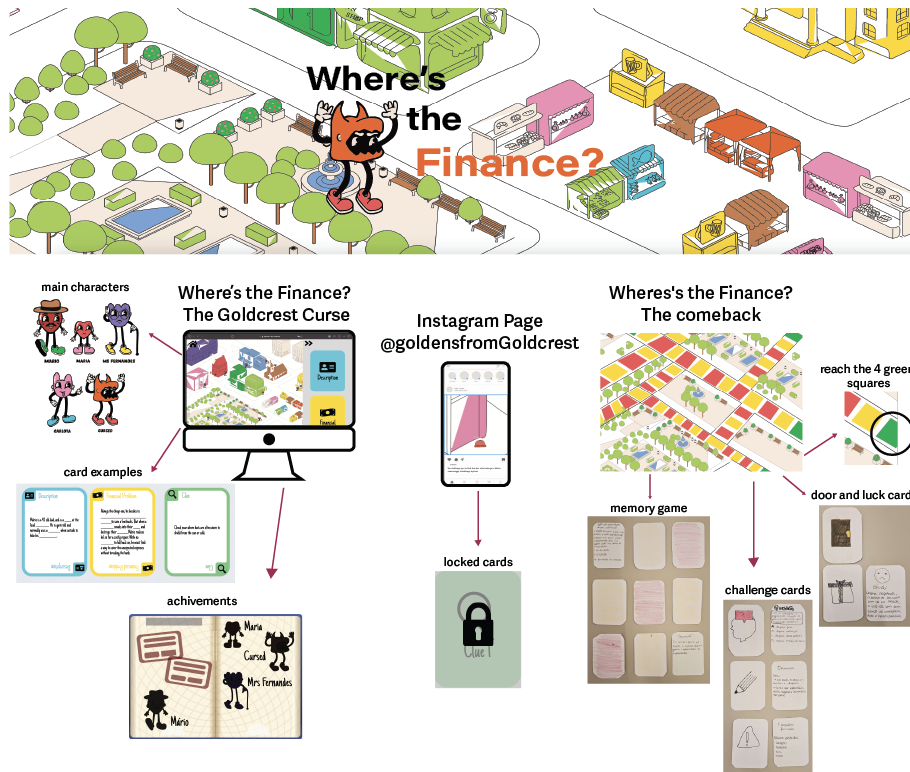


Figure 8: Final design of "Where's the Finance" transmedia, containing the web game, the board game, and the social media page

4.2 Branding

The name of the overall experience refers to the fact that there is a lack of financial literacy, and we played with that by asking where is the finance. First, we decided we wanted to use an illustration style inspired by retro times and "Rubber Hose Animation" [52], which was the first animation style that became standardized in the American animation field, since the topic of finances is an old concept and the old illustrations could give some nostalgia or tranquility to the players on this complex topic.

We started by creating the color palette, maintaining the retro feeling, we chose 12 colors. Figure 9 shows the choices mentioned.

We strategically considered color symbolism in our logos to convey themes and emotions associated with each game or platform. The logo, for the game "Where's the Finance?: Goldcrest Curse," which is a twist on the classic "Find Wally" ¹¹ concept features a retro pink tone. Pink was selected for its association with youthfulness, comfort, and innocence aiming to provoke feelings of nostalgia and fun [53], it complements the game's theme of exploration and discovery by offering

¹¹<https://wally.walker.co.uk>

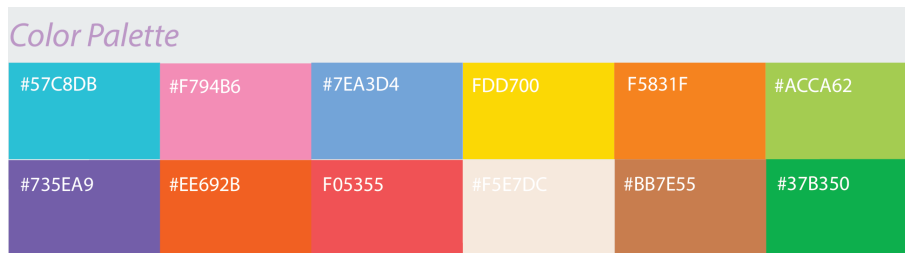


Figure. 9: Color palette used in "Where's the Finance" games

players a familiar tone among the game's challenges. In "Where's the Finance?: The Comeback," the board game, the logo is designed using the color blue. Blue, known as a symbol of trust and loyalty suits this game that highlights teamwork and collaboration [53]. The logo for the Instagram page "@goldens.fromgoldcrest", uses the color purple. The color purple has been associated with luxury, royalty, and mystery for ages [53]; hence it is an ideal choice to represent exclusivity and enigmatic in the clues provided, it offers some touch of sophistication and intrigue, enhancing the experience when resolving mysteries behind such games. "Where's the Finance?: Dreamscape" is a web puzzle game created by a colleague with whom we collaborated by contributing with design, its logo has an orange color. Orange symbolizes emotion, optimism, or danger so this color portrays both a difficult but positive aspect of gaming where players have to be creative thinkers taking risks through challenging puzzles [53]. The energizing effect of orange encourages players to remain determined and hopeful despite obstacles they may encounter.

The fonts used were simple and minimalistic, due to the complexity of the illustrations and the many colors used, for titles "Myriad Variable Concept" was used, and for regular text, we used "Roboto".

Then we developed the logo combining what was mentioned above, the title of the game is shown in capital letters with the font "Myriad Variable Concept Black semi condensed". Adding to this we created two main elements that symbolize the four media the transmedia comprises: the "A" in finance is replaced by a lowercase "a" divided into four; the four lines represent the paths we can take when making financial decisions in our lives. Figure 10 describes the design brief previously explained.

4.3 Where's the Finance?: Goldcrest Curse - Web Game

This media has a heavy storytelling component, and while playing people will meet five main characters, each of them has a life story and a financial dilemma. There are six levels, the first one

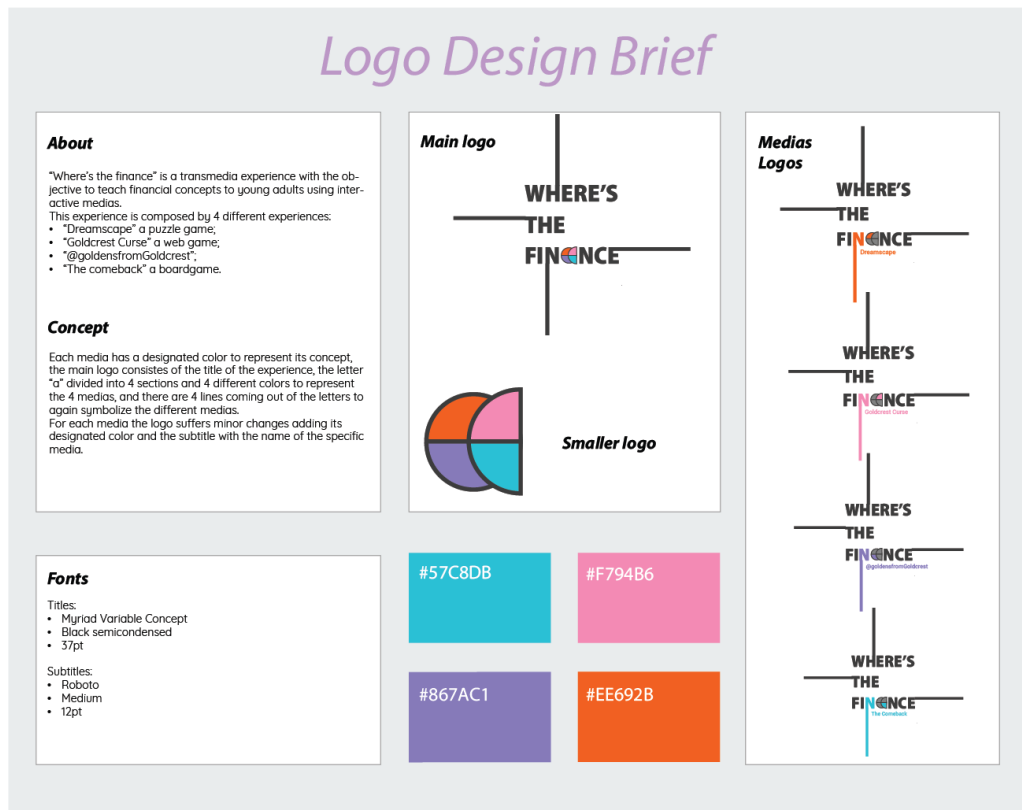


Figure. 10: Overall Design Brief of the branding for "Where's the Finance" media

is a tutorial and the other five are for each of the characters. The player needs to find the character in the big map to unlock more information about it and also more clues. We also made sure to strike a healthy balance between being an entertaining and captivating game for young adults and presenting these more abstract ideas. This media is an individual experience where players are introduced to financial topics in a less complex way, in this media they can progress at their own pace and test their own knowledge.

Figure 11 shows the evolution of the user interface, on the left we can see the interface before, and on the right we can see the user interface after the refinements.



Figure. 11: These images show the evolution of the user interface, on the left we can see the interface before, and on the right we can see the user interface after the refinements. The first line shows the beginning of the story where the Mayor is explaining the dilemma, the second line shows Mário's folder and cards, and the third line shows the solved cases folder.

4.3.1 Narrative and Characters

The town of "Goldcrest" is facing an unknown curse, we can explore the charming town and its surrounding landscapes, marketplaces, and houses. The Mayor of the town tasks the player to uncover this curse that is turning the people into dark creatures, the quest consists of helping five townsfolk to lift this curse and see if they can help save "Goldcrest" from this darkness. Figure 12 is the first draft of the concept art for the characters.

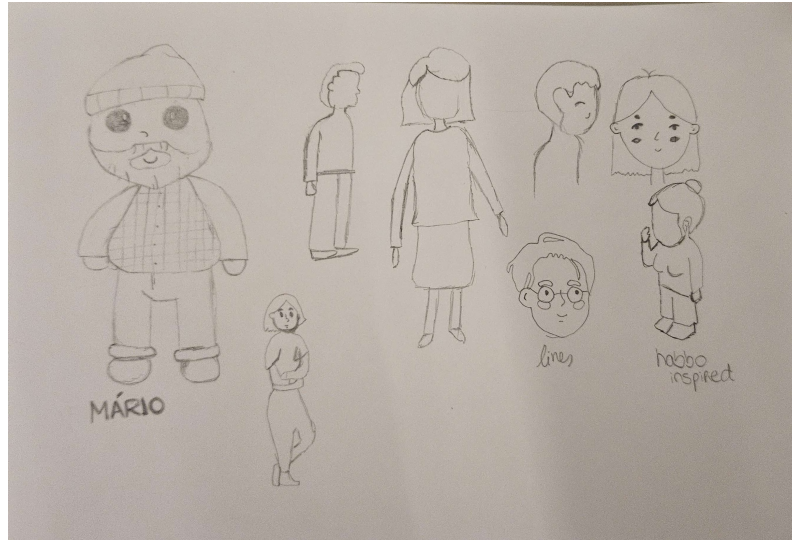


Figure. 12: First draft for the concept art for the characters of the game

For the first level, we have Mário, a 45-year-old father, who teaches at the nearby secondary school. Despite his height, he usually wears a beanie outside to conceal his thinning hairline. Ever the cheap one, he chooses to forgo the renewal of his home insurance to save a few dollars. However, Mário discovers he will need to pay a high amount of money for repairs when a dark entity breaks through the wall in their attic, and he needs to figure out how to pay for the unexpected costs without going over budget because he doesn't have an emergency fund to fall back on. Figure 13 illustrates how we used the five-act structure to tell his story. Figure 14 shows the final design of the Mário character.

For the second level, we have Maria, a 12-year-old who is Mário's daughter. She found herself running out of her allowance too quickly due to her passion for buying slime, and impulsive buying. She took the initiative to learn about budgeting rules, in a local workshop. She used her budgeting skills to help her father create a household budget, categorizing their monthly expenses, and setting

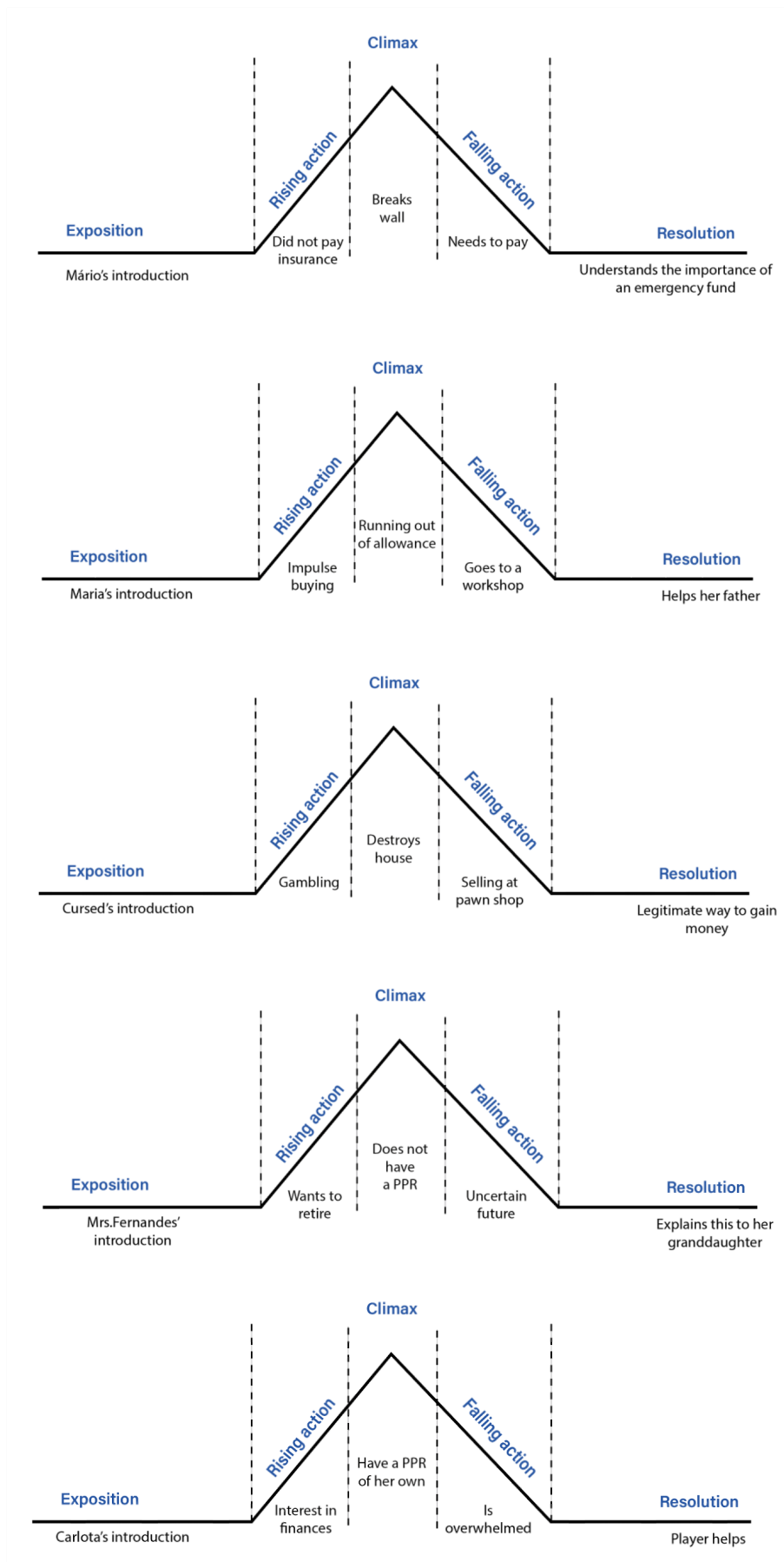


Figure. 13: Five diagrams illustrating the five act structure for each of the characters. The first one is for Mário's, second if for Maria's, third is for Cursed's, fourth is for Mrs. Fernandes', and fifth is for Carlota's.

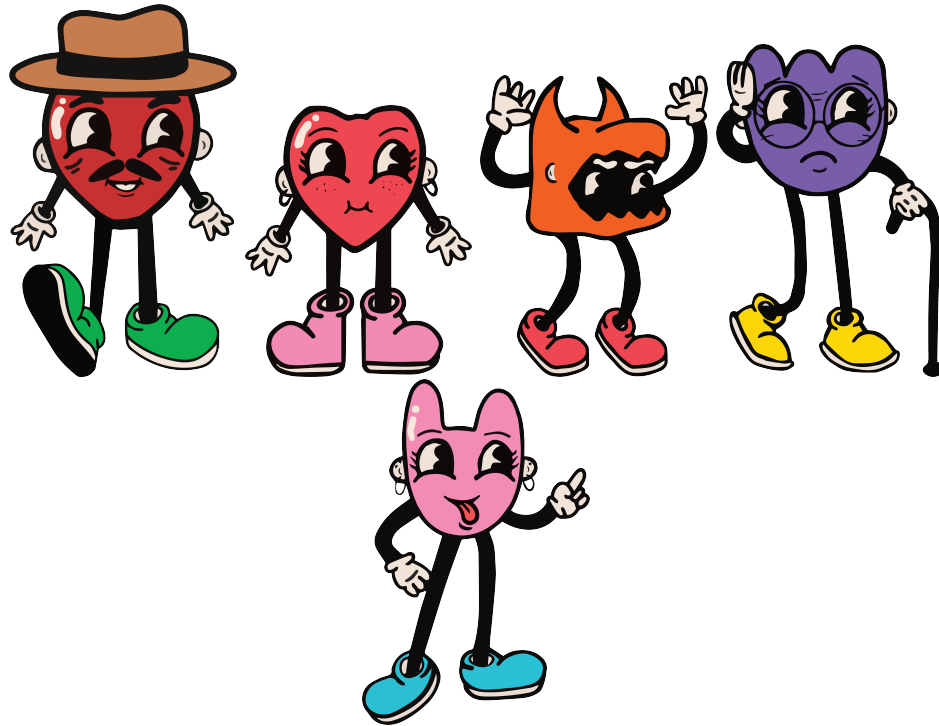


Figure. 14: Characters' final graphic design character. On the top, from left to right, there is Mário, Maria, Cursed, and Mrs. Fernandes. On the bottom, there is Carlota.

specific goals. Figure 13 illustrates how we used the five-act structure to tell her story. Figure 14 shows the final design of the Maria character.

For the third level, we have Cursed despite his small stature, his boldness knows no bounds as he navigates the bustling streets of the town, leaving a trail of chaos and confusion in his path. Like many individuals, he is drawn to the allure of quick and easy money, and gambling is the shortcut to wealth without considering the potential consequences. With this gambling problem, he finds himself deep in debt, becoming a cursed identity. Desperate to regain his true form, he resorts to desperate measures, by raiding Mário's attic in search of valuables to sell at the local pawn shop. However, his search was not successful and he now must find a legitimate way to earn enough money to clear his debts. Figure 13 illustrates how we used the five-act structure to tell his story. Figure 14 shows the final design of the Cursed character.

For the fourth level, we have Mrs. Fernandes, she is the kind-hearted elderly neighbor of Mário. Having spent her life dedicated to her work and community, she dreams of retiring to pursue her passions and spend more time with loved ones. However, she finds herself at a crossroads on how to afford her desired lifestyle in retirement. Despite her good health and optimism for the future, she lacks a retirement savings plan to support her transition into retirement, without one she faces

uncertainty about her financial future. Figure 13 illustrates how we used the five-act structure to tell her story. Figure 14 shows the final design of the Mrs.Fernandes character.

For the fifth level, we have Carlota, the bright and ambitious granddaughter of Mrs.Fernandes, who possesses a keen interest in personal finance and a determination to learn from her grandmother's experiences. She is on a mission to explore the best retirement savings plan options to set herself up for a comfortable and secure retirement. However, she's overwhelmed by the amount of options available and unsure where to start. Figure 13 illustrates how we used the five-act structure to tell her story. Figure 14 shows the final design of the Cursed character.

The characters' shapes were designed in a non-human form to make the players detach themselves from their financial anxieties. Still, at the same time we tried to make the narrative relatable and situations that are present in everyday life.

4.3.2 Design Rational

The game was designed to help players understand savings and expenses. To do this, we created five levels to tackle each of these topics. The topics for Mário's level are emergency funds, the topics for Maria's level are budgeting rules and types of expenses, the topics for Cursed's are gambling problems, the topics for Mrs.Fernandes' are retirement savings funds in old age, and the topics for Carlota's retirement savings funds in younger age. We used a braided narrative [54] aiming to have these stories merge into each other, making the characters family members and also making them interfere negatively in each other's lives.

We wanted to ensure that the game remained educational without sacrificing the fun, and to do that we incorporated the financial knowledge with each of the clues given to find the characters, giving the users an objective while clutching knowledge at the same time. For example on the first level, Mário's level, the character can not pay for his house insurance because he does not have an emergency fund, in the game the player will find his house and learn that he can not fix this because of his lack of financial literacy. Another example is in Caralota's level, where the players need to help her choose the best savings plan for her, to do this they have to read the specificities of three savings plans and correctly choose the best one. Additionally, we only introduced one/two topics at each level, consequently leading to less confusion and more focus on each of the topics.

To maintain engagement with a complex matter like this one, we used rewards like points and stickers and sound feedback for correct or incorrect interactions, and we also wanted to create a way to have some hints if they got stuck.

4.3.3 Gameplay Mechanics

The core gameplay of the game is, to read the characters' descriptions and financial situation, and then they can unlock clues situated on the right side of the screen, and the objective is to find that character on the map. Throughout the gameplay, players would unlock the next level to keep playing. To maintain a challenging gameplay each level had a higher level of difficulty than the one before. To move the players use the mouse while pressing the right button and dragging, to zoom they can use the mouse wheel. To hide the characters on the map we tried to put them near the buildings that had the same color as them, and we also created other characters alike but in different colors or different accessories. We also have a scoring system, to gain points players need to find the characters, if this happens the happiness level of the city increases. They lose points if they choose the wrong character and the city's happiness declines. The game finishes when the player ends all levels and the Mayor talks with them telling them how the city was saved and the reason for its curse.

4.3.4 User Interface (UI) and User Experience (UX)

When the users enter the game, there is a splash screen with the title of the game and there is only a "start" button, figure 15 shows that screen. After that, the Mayor's character explains what is



Figure. 15: Splashscreen for the web game, with the start button on the bottom

happening with the town of "Goldcrest", for the dialogues we used a box with a pink outline and an arrow to continue the dialogue, but for a better user experience, the dialogue continues if the



Figure. 16: Mayor's dialogue screen to give context to the game, with an arrow to continue.

user clicks anywhere in the box, figure 16 shows that screen. After that, we created a tutorial to teach the user how to navigate the map and we designed a mouse with the actions that users need to perform to zoom and move in the map, figure 17 shows that screen. On the screen, we also display the score and the happiness level to give the players feedback and a reward when they find the character, figure 18 shows that screen. Additionally, on the top right side of the screen, we have four buttons, we tried to keep it minimalistic since the most important part is the map, and we have a help button so that the user does not get stuck, then we have the badge where for each level the user is rewarded with a sticker, then we have a home button to exit, and then we have the folder icon, figure 19 shows that screen. . We also created a tutorial level to familiarize the users with the game creating the best user experience possible, figure 20 shows that screen. To add another layer of feedback we added a confetti animation so the users know when they have found the correct character, additionally when that happens a correct sound is played, but if the character is wrong an incorrect sound is played, figure 21 shows that screen. For each level, we created a folder with a polaroid to hint at the character's appearance, in the folder we can also see the financial situation and description, also the clues are shown on the folder, figure 22 shows that screen. To show users that the clue is locked we created an overlay with a locker, and we also decided to show the clue for the object on the green part of the card and the clue for the character on the white part of the clue to avoid confusion in what the users need to find, figure 23 shows that screen.

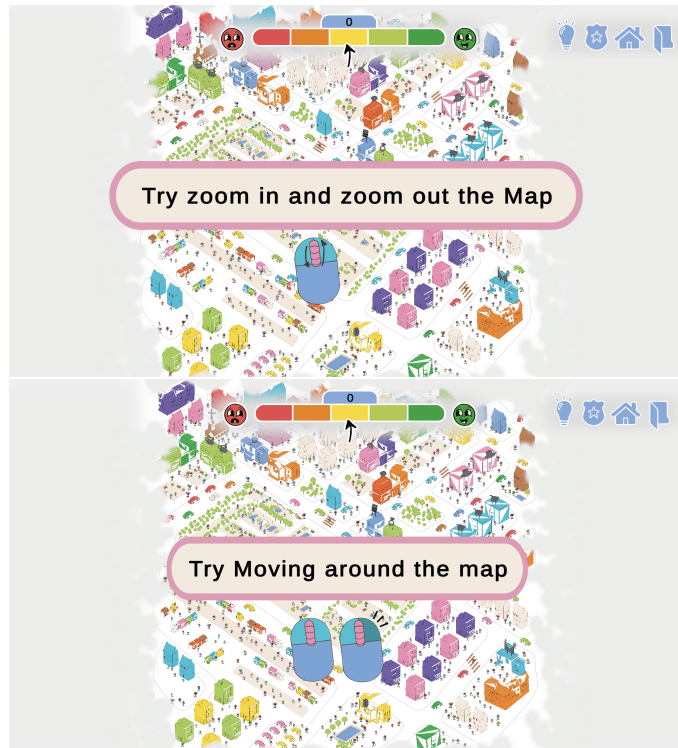


Figure. 17: Two screens showing the tutorial for moving and zooming in the game. Top image shows how to zoom in and out using the mouse, and the bottom image shows how to move around the map using the mouse.

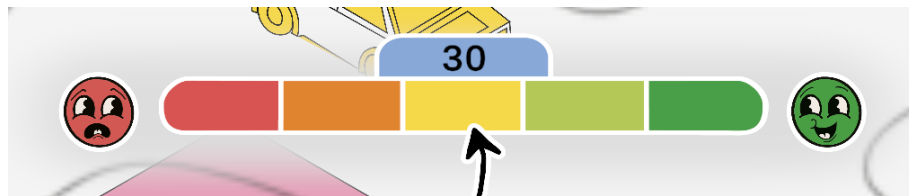


Figure. 18: Example of a score of a player, and the happiness level of the town, that shows on the middle top part of the screen.



Figure. 19: Icons in the right top part of the screen, from left to right we have a help icon, a badge icons, a home icon, and a folder icon.



Figure. 20: Four screens showing some of the tutorial steps on how to play the game, in the Anita's level.

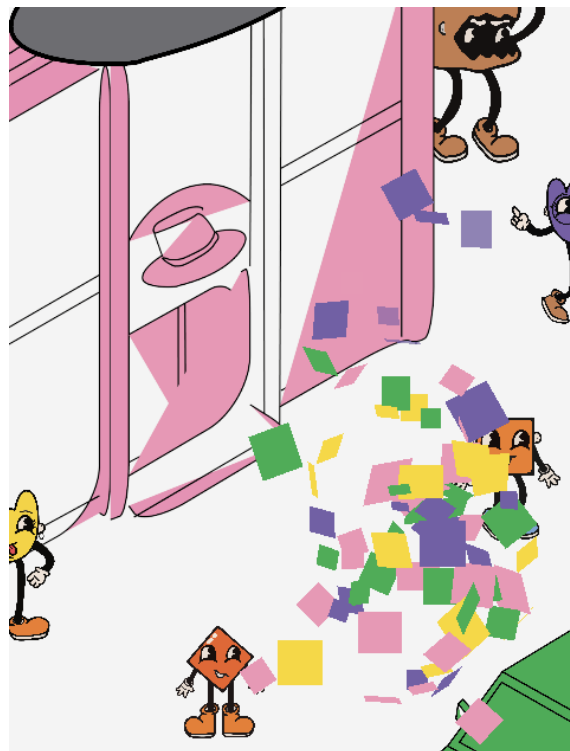


Figure. 21: Confetti are a visual feedback when the correct character is found

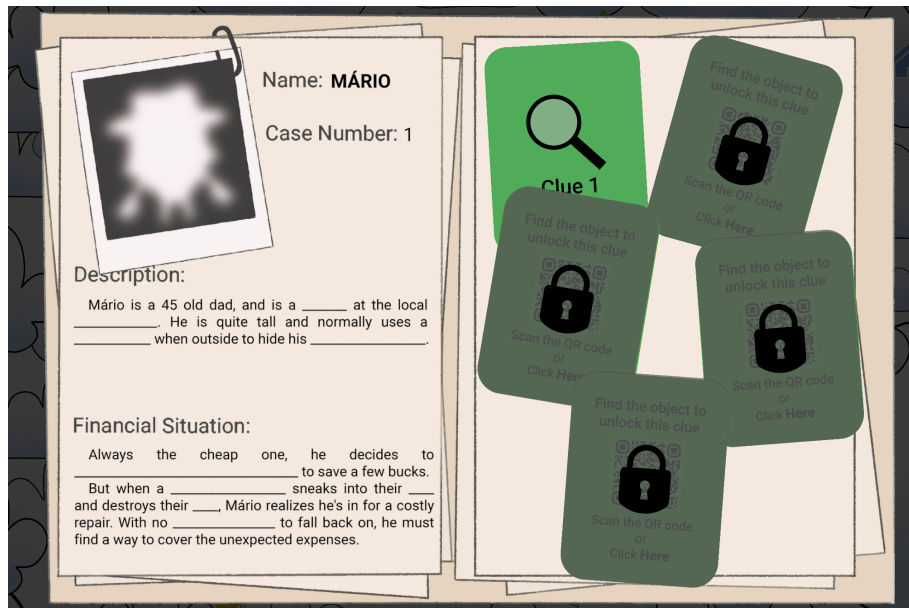


Figure. 22: Mário's folder where we can see his blurred polaroid, a description, his financial situation and his clues on the right side of the folder

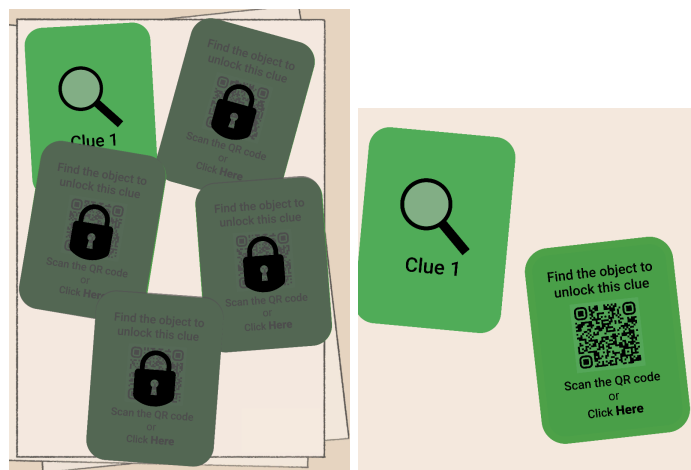


Figure. 23: Image on the left shows the locked overlay used to show how the card is locked, and on the right we have the QR code on the green part.

4.3.5 High-level Prototype

In this section, we discuss the high-level prototype created, the user experience tests conducted, that are described in Section 4.6, and the refinements made based on the feedback.

Prototype development is a crucial stage in the game development process, at this stage, the game was not the complete version of the final product. This allowed us to test core gameplay mechanics, gather participant feedback, and identify what could be improved before committing to a final product.

The high-level prototype for the web game was created using Unity, and the programming and setup of the game in the program was executed in collaboration with our colleague Ana Santos, this collaboration consisted of us creating the design assets for her project and her creating the programming part of our project. This prototype included 4 levels, including a tutorial level designed to introduce players to the game mechanics (Anita), followed by three progressively more challenging levels (Mário, Maria, and Carlota).

A broad set of graphic design elements were all hand-drawn with Adobe Illustrator ¹² and Procreate ¹³; including map assets such as benches, bushes, trees, buildings, cars, crosswalks, pools, water fountains, market stalls, building icons for better identification of the type of building; including 116 character designs that were duplicated more than once when populating the map; including user interface icons such as the home, badge, help, and folder; including detective folders with description, financial situation, and polaroid for each of the characters; clue cards with and without the QR code and also the locked overlay for the locked clues; including case folders for each character; including sticker folders for each level completed; including a splash screen; and clouds and fog to hide the non-interactive part of the map.

The Mayor character was introduced, along with dialogue boxes to facilitate interactions and provide additional information. Specific objects that correlated with each character's story were incorporated into the game to integrate with the Instagram component, such as a beanie, a broken wall, financial flyers, hats, benches, a piggy bank, slime, and some building icons, for players to find. Figure 24 and 25 show all the assets used in the map and all the characters created for the game, respectively.

¹²<https://adobe.com/products/illustrator>

¹³<https://procreate.com/>

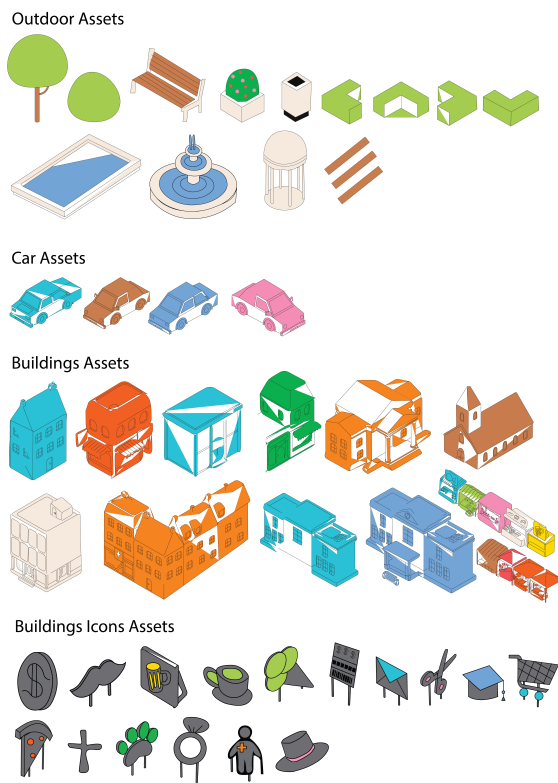


Figure. 24: Asset sheet with all map assets: outdoor assets, car assets, building assets, and building icons assets

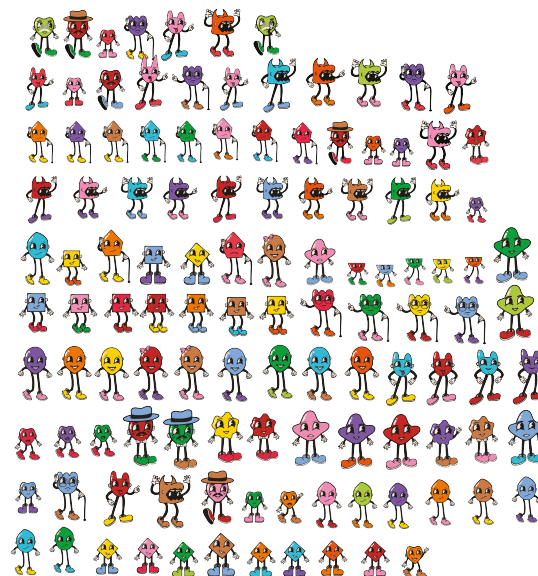


Figure. 25: Characters sheet with all 116 characters that are represented in the map

4.4 Where's the Finance?: @goldens.fromgoldcrest - Social Media Page

This media was created to make the web game more interactive and even more realistic, in the sense that young adults use their social media every day, and because a detective can not find clues without looking for them. We decided to use Instagram as our social media app because it is currently one of the most popular social media apps among young people around the world [55]. After the first clue the others are locked, the players get a QR code, or they can use a link, that redirects them to an Instagram post, there they have a carousel with two posts: a "meme" [56] about the financial topic of that level, and a zoomed-in image of what they would need to find on the web game map. When this object is found the clue unlocks helping to find the character's location. For example, in Figure 26 we see the QR code that leads to the Instagram post. The image on the left shows the QR code that leads to the Instagram post in the middle and the right. The image in the middle is the first on the carousel and is the "meme", the second on the carousel is on the right and is the zoomed part of the map.



Figure. 26: Image on the left shows the QR code that leads to the Instagram post in the middle and the right. The image in the middle is the first on the carousel and is the "meme", the second on the carousel is on the right and is the zoomed part of the map

This idea makes the players feel even more immersed and like a detective since they have to search for objects in the world.

We created consistent backgrounds that were interconnected in the profile's feed to maintain a cohesive visual style. A character was intended to appear in every Instagram post so that users understood that they did not have to find that character on the map. This issue was resolved by making a new character that wasn't on the map.

Additionally, we also shuffled the posts so the participants would not know the order of the objects to find. Moreover, since financial literacy is in people's everyday lives we wanted to connect that with social media because that is something most young adults use every day having this analogy between the two. Figure 27 shows the complete look of the Instagram page and how the posts intertwine.

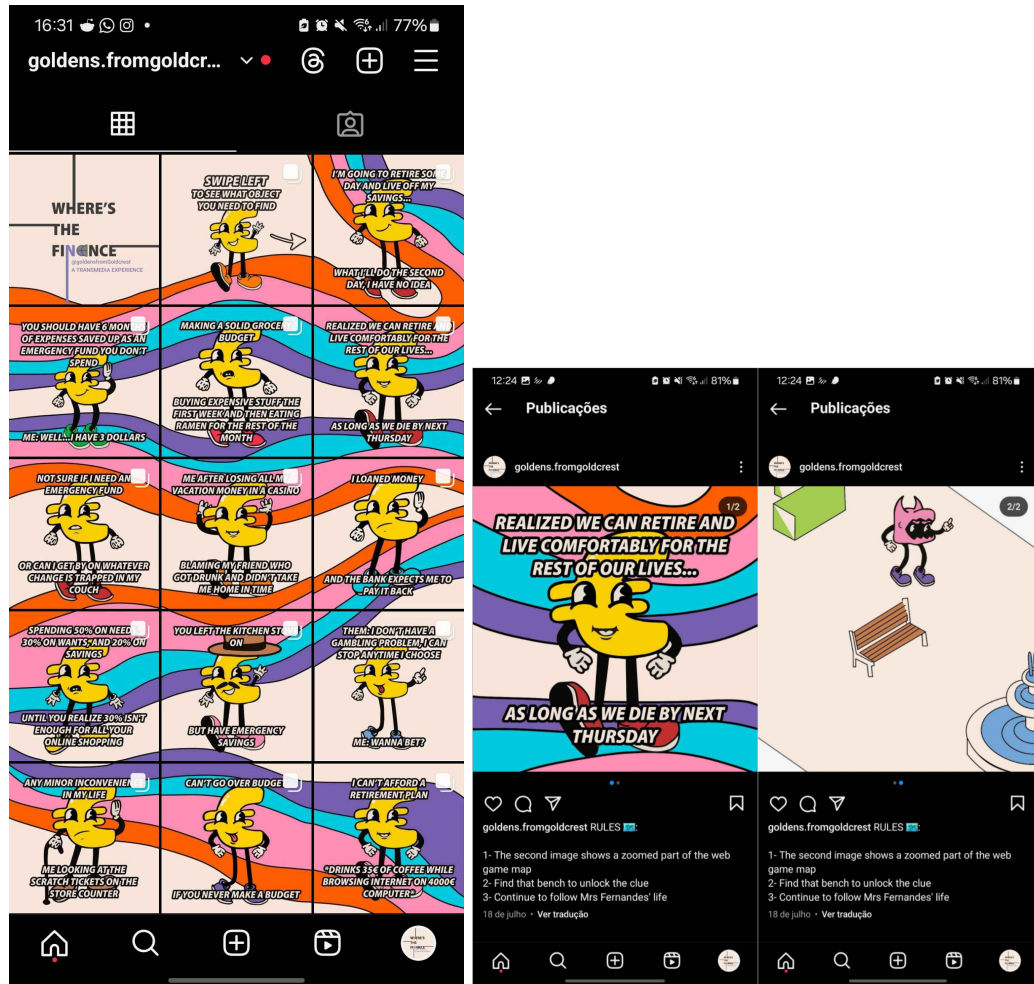


Figure 27: Left image shows the redesigned Instagram feed with a new character in all of the posts. The right image shows the layout for each of the Instagram posts, a financial "meme" and then on the carousel a zoomed in image of the object to find.

4.4.1 Posts Layout

For the design we have a carousel for each post, consequently, each level would have some posts corresponding to the number of locked clues, the background would repeat itself, and the character in the center would be a character that does not appear on the map to not confuse users because they could think they needed to find this character on the map. Each poster (the first image on the

carousel) was designed using Adobe Illustrator ¹⁴, combining the financial quote, the character, and the background with the color palette previously quoted. For example, in Figure 26 in the middle, we can see the character with the sentence related to the financial topic, retirement planning. Figure 27 illustrates the layout for each of the Instagram posts.

4.5 Where's the Finance?: The Comeback - Board Game

4.5.1 Narrative and Characters

This game, chronologically, would take place after the web game, in the board game the characters already learned from their mistakes and now will test them and learn even more financial concepts. Each character has a token and also a power that can be used every three turns. Each power is directly related to each character's previous financial situation, Mário can use his resourcefulness to solve problems without spending resources, and he can exchange a challenge card; Maria's entrepreneurial spirit allows her to network effectively, and she can form alliances or partnerships with other players, gaining benefits such as using other token's power; Cursed's keen instincts enable him to adapt very well to change, he can choose to re-roll one of the dice; despite not having a retirement savings plan, Mrs. Fernandes has a wealth of life experience, she can walk two more spaces; and finally, Carlota excels at managing risk in her retirement plan, so she can draw a present card.

4.5.2 Design Rational

In this media, the players build knowledge from one another and progress through the game according to the team's knowledge and speed, making it a more collaborative experience. The financial topics are also more complex than the web game. The board game fosters a collaborative environment where the team players work together to achieve the goal of collecting four stamps by reaching the four different buildings in the order described on the objective card. We introduced cooperative challenges that require teamwork and communication. For instance, one of the challenges was to draw a financial concept that other team members could try and guess. To introduce financial knowledge, since the gameplay was already complex we opted for a simple way to gain knowledge with a simple game, such as a memory game with the concepts. To strike a balance between education and fun we used interactive gameplay, humorous elements like funny quotes on the present cards, and rewarding challenges.

¹⁴<https://www.adobe.com/pt/products/illustrator.html>

The map was printed. New rules were put into place and objective cards were added to make the experience more replayable and challenging. The objective buildings could be moved around the board, adding an element of surprise and strategy. We printed and cut the ten cards of each challenge to get a physical manifestation of the various challenges within the game. We used physical dice and pawns and glued the challenges on the dice, the characters on the pawns, and the objective buildings on the pawns.

Figure 28 shows how the final design of the map looks.



Figure. 28: Final map design for the board game

4.5.3 Gameplay Mechanics

All players start on the same square, and there are four buildings that they need to reach, following an order. There are objective cards that explain what buildings the players need to reach in a certain order, to make it more challenging the arrows on the map if reached can rotate the buildings clockwise. Each square has a color and sometimes a symbol, red represents the expenses theme, yellow is the savings theme, and when the player stops on those they have to do the color challenge of the square color. The clover symbol means that the players can draw a luck card, that could be good or bad. Teams take turns using the dice, one will dictate how many spaces they move, the other dictates which challenge they have to go through, one of the team players will do the challenge (drawing, forbidden words, question savings, question debts) and their team must try to complete it, if the team can complete the challenge on time, they can throw the dice to move but only on their next turn can they throw the dice to see what challenge awaits, if the team can't

complete the challenge, they lose their turn and must repeat the same challenge but with a different card, on their next turn. Furthermore, they can not move diagonally but can move backward, they don't have to move all the spaces on the dice, for example, if the dice has five moves they can move less than that but never zero. For the drawing challenge, there can't be drawn numbers and letters, for the forbidden words challenge they can not say any of the words that are contained in the title and none of the forbidden words, they have 40 seconds to complete the challenges. Figure 29 shows how the final pamphlet of the rules looks.



Figure. 29: Modified new rules for the board game, on top are the first pages on the bottom are the pages for the back of the pamphlet

4.5.4 Assets

The assets that compose this game are a board, 2 different dice (one for moving, one for the type of challenge), a rule brochure, 5 cards for each challenge, 5 present cards, a forty-second hourglass, pencil, and paper. For the first informal playtest, to gather initial feedback on the design and game mechanics, the prototype and assets were made by hand. Figure 30 shows all the physical assets created.



Figure. 30: The image on the top shows the assets created for the board game, the buildings, the tokens, the stamp cards and the dices. The image on the bottom shows all the challenge cards created.

4.6 Concept Validation and User Feedback

Concept validation and user feedback are crucial stages in interactive media production, ensuring the game meets educational goals and is enjoyable and interesting for users. This subsection describes the processes aimed at its validation and user participation in the development process, what methods were employed, and what were the results of these activities. For the informal playtest we recruited participants from our circle of family and friends, for the user experience test we recruited participants that we did not know.

4.6.1 Informal Playtest

Playtesting is crucial, it provides us with feedback on what works and what needs to be better, in this way through the feedback from a small group we would know exactly how the game was being viewed and what needed to be adjusted before unleashing the final version. In this case, an informal playtest was carried out, with a small group of fellow researchers and family members who participated by playing both media (board game and web game) and then were asked to provide feedback on different gameplay aspects and design. We tested both the board game and the web game by integrating the Instagram page. For a more comprehensive exposition of the suggestions and refinements from this test, we grouped it into suggestions and refinements from each media. The letter close to the number of the suggestion relates to the media: B for the board game, W for the web game, and S for the social media page.

Suggestions for the board game were:

1B - Web game elements such as locations and backgrounds should be consistent with the board game.

2B - Added difficulty and discovery aspect of the map;

3B - Confusion on what the question mark might mean, many thought it was a question challenge;

4B - Due to the small number of cards the challenges felt repetitive and easy

Refinements made taking into consideration the suggestions and observations of the participants:

We renovated our board and integrated more visuals from the web game, as well as added the buildings that exist in the web game (**1B**), we can see it in Figure 28. To raise the difficulty and discovery aspect of the board game, more can be added to the map (e.g. obstacles), so we implemented a tile in which players could move the objective, which made players think and plan their moves with care (**2B**), we can see that on the yellow square of Figure 31. We also exchanged the question mark tile with a clover tile, to represent the luck cards (**3B**), we can see that on the red square of Figure 31. We created new cards with more questions, challenges, and luck events, making the game more varied and replayable (**4B**).



Figure. 31: On the red square we can see the clover symbol that represents the luck cards, and on the yellow square the arrows that is used to rotate the objectives

Suggestions for the web game were:

1W - The user interface could deliver a richer sense of being a detective;

2W - The wording of the clues was abstract and felt like charades rather than clues;

3W - During the gameplay participants felt lost on what to do next, having no help they would feel frustrated;

4W - Some participants suggested that there should be some type of score system to engage users further;

5W - Participants felt that there was no feedback when they found the correct character or the wrong one, having no idea if they made any progress;

6W - Some participants had difficulties understanding that only one clue at a time would be unlocked;

7W - Finally, participants felt like the game lacked sound and ambiance.

Refinements made taking into consideration the suggestions and observations of the participants:

To the folder, we added a description and a blurred polaroid image of the character to find in a folder for cases, in which we can also see the clues, scattered around it (to give more realism), and we also added folders for completed cases. Furthermore, by doing this we also simplified the navigation and menu structure making for an improved game feel as well (**1W**), we can see that in Figure 22. Offering clues that were less abstract and did not need a leap in logic made the player understand better and more easily find the characters (**2W**). Additionally, the participants felt lost on what to do next, to solve this we decided that the addition of a tutorial level would be beneficial (**3W**). We also created a scoring system to further engage players (**4W**) we can see that in Figure 18, we added a confetti animation every time the players found the character to give feedback (**5W**) we can see that in Figure 21, and we also added a card overlay with a lock so the players would understand that those clues could not be interacted with yet (**6W**), we can see that in Figure 23. Last but not least the sound effects, imitating the noise of a city in the background as some ambiance made the overall environment even more immersive for the web game (**7W**).

The Suggestion for the social media page was:

1S - Inconsistent feed on the page, there was no connection between the posts.

We refined that by creating a visually cohesive and engaging social media feed, using Procreate and Adobe Illustrator we illustrated the backgrounds for each post, making them connect if seen from the profile page, and also maintaining a consistent font and color scheme (**1S**), we can see that in Figure 27.

By addressing these feedback points, we significantly improved both the board and web game, creating a more enjoyable and engaging experience for players.

4.6.2 User Experience Tests

After the refinements from the previous informal playtest, user experience tests were conducted concerning the high-level prototype during the LARSyS Annual Meeting at Pavilhão do Conhecimento. Due to time limitations, we could gather nine participants over two days and test our web game and Instagram only. The participants were only instructed on how to progress through the game and how to interact with any of its features if they got stuck or had any doubts. The participants were allowed to go through the game freely, at their own pace, and get a feel of the game. Observations were made during the test sessions, and a few informal questions, such as "Did you like the design?", "Was it easy to follow the game?", "Do you believe this game could help you understand financial concepts?", "If you could what would you change in this game?", were asked to gather some quantitative data. Figure 32 shows one of the participants who took curiosity in testing our prototype.



Figure. 32: User testing at LARSyS Annual Meeting 2024, the face of the participant was blurred to maintain anonymity

The participants universally praised the graphic elements, color palette, and overall aesthetic of the game, finding it visually appealing and engaging. Even though the experience was great overall, some users pointed out several issues regarding the navigation of the game. They specifically mentioned it would be more forgiving if players were informed of when to actively search for objects or characters. Many users thought that, in principle, the game could effectively teach them financial skills but such elements should be emphasized better or embedded in the design more effectively in order not to make the game lose its educational purpose.

The Instagram part was in particular highly appreciated as it was able to add value and interest for the users. Other users recommended increasing the extent of interactivity on Instagram to make this integration more effective. A few more recommendations were made such as incorporating tutorials at the start of the game for players to understand how to play the game and its goal, using directional or other types of aids to assist players navigate more readily through the game, promoting better synthesis of educational materials into the game.

4.6.3 Refinements

Based on the results of the usability tests, several refinements were made to the prototype to improve the player experience and narrative clarity. These changes were primarily focused on design and programming. The design changes were:

- Detective’s Story - The detective’s story was enhanced to provide a clearer purpose for the player. Details were added about the detective’s motivation, objectives, and the concrete benefits of playing the game.
- Mayor’s Name - The mayor’s name was added next to his image for easier identification and to avoid confusion. Additionally, the mayor’s facial expression was adjusted to reflect the situation more appropriately, giving him a sad face.
- The character on Instagram - The character on Instagram was changed to one that does not appear on the map to avoid confusion. Figure 27 shows the new Instagram feed with the new character.
- QR Code - The QR code was positioned on the back of the card to prevent players from getting confused about what to find (character or object). Figure 33 illustrates the before and after.

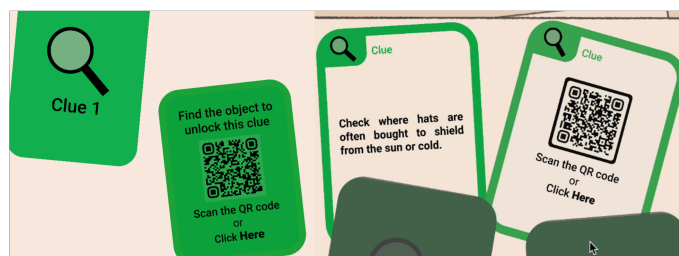


Figure. 33: The image on the left show how the refined version of the QR code card looks, while the image on the right is the previous version of the QR code card.

- Icons - The colors of the icons were adjusted, and a blur effect was added to the background to improve readability.
- Clouds - The style of the clouds was modified for a more minimalist design since it is not the main focus of the game. Figure 34 illustrates the before and after.

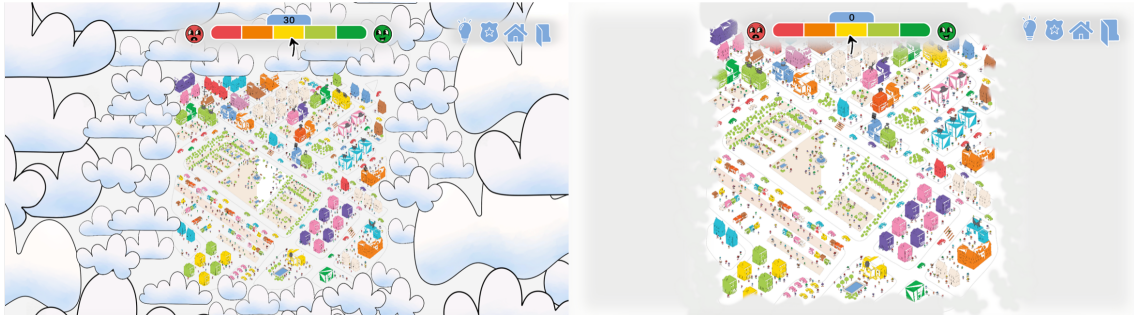


Figure. 34: The image on the left shows how the previous version of the clouds looks, while the image on the right is the refined version.

- Dialogues - The text in the dialogues was reduced to make the conversations more concise and easier to follow.
- Arrows in Tutorial - Arrows were added to point to the "clue description" and "financial description" sections in the tutorial.
- Card Text - The text on the cards was standardized to "find the character" (or the name of the object to be found) to make the task easier to understand.
- Music - A soundtrack of city sounds was added to create a more immersive and engaging atmosphere.

The programming changes were:

- Dialogues - The background of the screen is blocked during dialogues to avoid distractions and ensure the player focuses on the conversation.
- Zoom - The game starts with a zoomed-out view to provide an overview of the scene.
- Tutorial - A mechanism was implemented to ensure players use the help feature during the tutorial, encouraging them to explore all available resources.
- Bug Fixes - Several bugs were fixed, such as the repeated display of instructions, the inability to click the "folder" button after exiting Carlota's level, and other issues.

With these changes, the prototype became more refined, intuitive, and cohesive showing how important it is to create several sprints to improve both design and gameplay.

5 Evaluation

In this section, we will delve into the two evaluations we did, one for the transmedia experience, and the second for the web game prototype. For both evaluations, in this chapter, we describe the protocol, metrics, qualitative, and quantitative results. The reasoning behind this division is explained in the subsequent sections.

5.1 Evaluation of Where's the Finance?: Transmedia Experience

This section describes the outcomes of the transmedia study developed to evaluate how effective our "Where's the Finance?" prototype was. The evaluation included both quantitative and qualitative measures. Specific research protocols and metrics, as well as detailed results of the study, are discussed in the following subsections.

5.1.1 Protocol and Metrics

Our protocol and metrics were designed to evaluate a transmedia experience containing the web game with the social media channel and the board game, the protocol for this test can be seen in Appendix B. Participants were recruited using a convenience sample by asking colleagues to bring acquaintances to test the prototype.

The session started with the researcher introducing herself and explaining what the study was about and how it would unfold, then a consent form was presented and any doubts were answered, the consent form can be seen in Appendix F. After that, each participant interacted with the web game using a "Think Aloud" technique [57], and the researcher took notes throughout and only helped the participant if stuck or if needed any translation. Thereafter, the participants created two teams of two and started playing the board game. Throughout this test we used shadowing ¹⁵, we were looking for gameplay mechanics problems and bugs but also for subtle usability issues that might not have been reported by the participants directly. By observing the players in real-time, we could see where they hesitated, seemed confused, or showed signs of frustration, providing deeper insights into their user experience. Following that, a semi-structured interview was conducted in Portuguese to accommodate the native language of the participants and make them more comfortable with giving more elaborate answers; the interview was recorded using a smartphone voice recording app to be later transcribed. In the end, the participants answered

¹⁵<https://www.interaction-design.org/literature/topics/shadowing>

an online form with the Mini PXI questions ¹⁶. We used semi-structured interviews, and the Mini PXI questionnaire, the form used is in Appendix H. The Mini PXI measures the player experience as a multi-dimensional construct and dissects how players experience the game: at the functional level (audiovisual appeal, challenge, ease of control, clarity of goals, progress feedback) and a psychosocial level (autonomy, curiosity, immersion, mastery, meaning and an added construct by the authors, enjoyment).

The study had a duration of approximately four hours.

Regarding the Semi-structured interview, we focused on four themes, experience with the media ("What was your initial reaction to the board game?", "How easy or difficult was it to collaborate with others?"), learning and engagement ("Do you feel that playing the board game improved your understanding of financial literacy?", "Can you give an example of something you learned?"), storytelling ("Was there a particular part of the story or any element of the transmedia experience that stood out to you? Why?"), suggestions ("If you could change one thing about the board game, what would it be and why?", "How could the web game be improved to enhance your learning or engagement?") and finally, we would ask "Is there anything else you'd like to share about your experience that we haven't covered?". The rest of the questions are in Appendix L.

5.1.2 Data Analysis

All statistical analyses described in this study were conducted using IBM SPSS version 28. For the Mini PXI questionnaire, the analysis involved a Likert scale which was modified from the previous Google Forms scale which was 1 to 7, to the normalized -3 to 3 scale in accordance with the study. We followed the scoring instructions to compute the overall Mini PXI score. The overall Mini PXI scores and dimensions of Mini PXI were documented for every participant. Regarding qualitative data obtained from shadowing and semi-structured interviews, thematic analysis [58] was employed to highlight and examine the themes encountered within the data.

We gathered 4 participants, and the study was conducted in our research center. These participants were between 22 and 25 years old two of them were female and the rest were male, the participants were recruited using a convenience sample by asking friends friends, and colleagues (who had not tested the web game). The highest score in the Mini PXI was 29, indicating that this

¹⁶<https://playerexperienceinventory.org/>

participant had a highly positive game experience. and the lowest was 14, suggesting a moderate game experience for this participant.

We created two Figures to illustrate the results of each participant for each construct of the Mini PXI questionnaire. Figure 35 shows the functional constructs, for instance, in terms of audiovisual appeal, challenge, and clarity of goals, participants ID1, ID2, and ID4 reported scores ranging from 1 to 3, reflecting a favorable perception. However, participant ID3 consistently reported lower scores, with a notable score of -2 in categories such as ease of control and clarity of goals, indicating dissatisfaction with these elements.

Figure 36 shows the psychosocial constructs, we observe that the majority of participants had a positive experience across various metrics. Specifically, 3 out of 4 participants reported high scores for Autonomy, Curiosity, and Immersion, with scores ranging from 2 to 3, indicating a generally good engagement with the game. However, one participant (ID1) reported a score of 0 for Immersion and Meaning. The Mastery scores were slightly lower, with all participants scoring between 1 and 2, suggesting there is room for improvement in how the game helps users feel a sense of mastery. Enjoyment scores were high for all participants except ID1, who had lower scores across several metrics. Figure 37 shows the participants interacting with the board game.

5.1.3 Qualitative Results

Regarding the shadowing we did, we collected mostly gameplay mechanics data, such as participants wanting to compete with the other on the web game scoring, the board game cards had difficult concepts to use on the challenges, most players wanting to use the phone to scan the QR code. The following overview displays the analysis of our interviews; PT stands for participant for the transmedia.

Transmedia Engagement: There was appreciation for the multi-platform nature of the game, this transmedia approach showed positive results in the learning experience making it more interactive and dynamic, an example is *“It was a good idea. It was a dynamic idea because in a way we managed to not always be around the same thing, so we can interact with different technologies.”* (PT1). The participants noticed that the integration of these different media prevented the game from becoming monotonous, the participants transitioned between media easily starting with the web game to get to know the characters and with integration with the social media, and the then

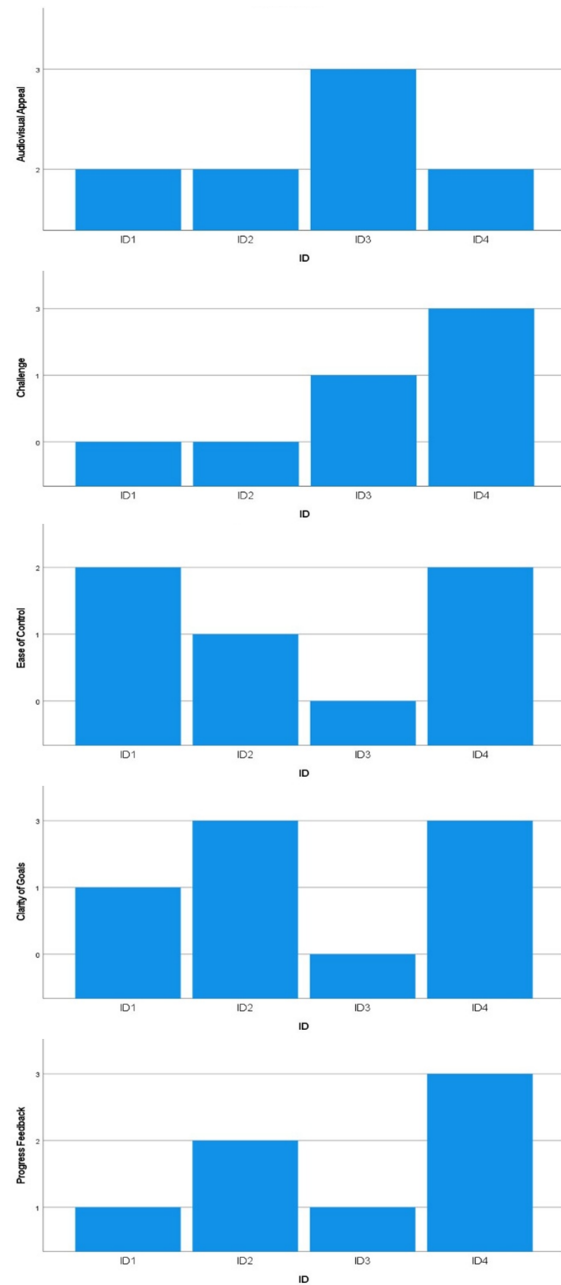


Figure. 35: Mini PXI constructs for each of the participants (ID1-ID4), we have audiovisual appeal, challenge, clarity of goals, and progress feedback

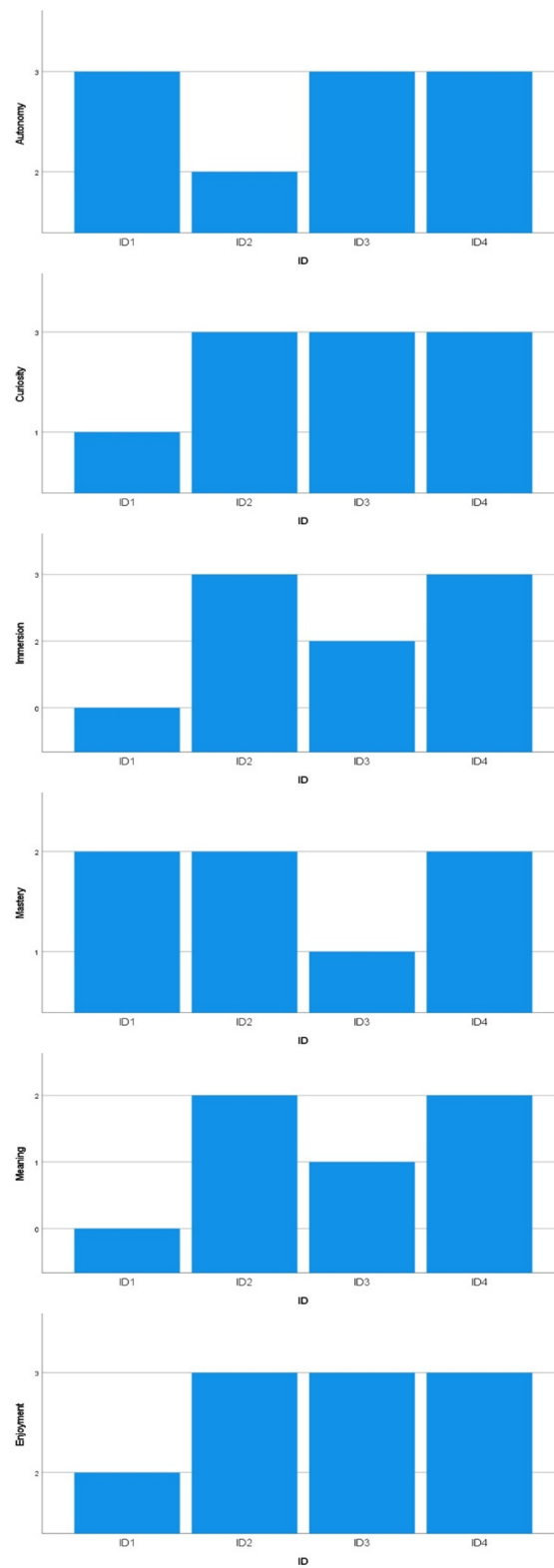


Figure. 36: Mini PXI constructs for each of the participants (ID1-ID4), we have autonomy, curiosity, immersion, mastery, meaning, and enjoyment



Figure. 37: Two images showing participants interacting with the board game component of the transmedia. On the left it shows the four participants and the board, and on the right it shows one of the participants doing the drawing challenge of the game

board game, a participant said *“I think it provided a good educational tool overall, the three [the three media] of them together.”* (PT2).

Financial Literacy Improvement: Most participants believed that the transmedia helped them improve their financial knowledge and also helped clarify previously known concepts that could be more confusing, one participant said *“Yes, I think it’s improved [the financial knowledge], because it’s like I said before, I’m a bit of a literacy buff and I think these types of games make... It’s good to raise awareness.”* (PT2). They also noticed that if there was no repeated exposure to the knowledge they would have more difficulty in remembering, in the long run, an example was the topic about PPRs because in this part they had to read several times and choose the right answers having a more repeated exposure, for example one participant felt like the Carlota level helped because they had to read several times the PPRs, repeating the exposure *“Maybe the part at the end of Carlota’s level, the part where we really had to analyze what the difference was between the three types of PPRs.”* (PT1),.

Engagement: The participants considered the web game engaging due to its interactivity and different kinds of challenges, they also mentioned that the score kept them engaged, for example, *“The score increased my engagement simply because I had the goal of being ahead of other people.”* (PT1). On the other hand, some found the complexity of certain financial terms or the repetitive nature of some challenges to be disengaging, for example, this participant felt more focused when started finding the characters *“What kept me more focused was starting to get the clues right”* (PT2).

Story Immersion and Notable Story Elements: Appreciation for the storytelling elements in the web game and the characters' stories, helped make financial concepts more relatable and easier to understand as well as allowing participants to connect on a personal level with the content, a participant said *"It had an impact for the simple fact that each story represented a different person and that person had their own needs."* (PT1). This approach made the learning more meaningful since they could see the implications of poor financial decisions in the characters' lives, for example, *"That's why the story, the story of the characters, is impactful so that you understand the knowledge."* (PT4).

Instagram Component Usability: Participants found that the use of the Instagram component was easy and it made sense since it is a familiar platform to young adults creating an analogy since also financial literacy is something we use every day, for example *"Yes, as it has two options, mobile and computer, it is easy to use if you are playing on the computer and automatically opening Instagram is easy."* (PT1). It made the game feel modern and realistic because, like a real detective, they had to find the clues on their own, they also felt that the transition between the media was seamless and that it could be expanded to more media, a participant said *"Instagram is cool. Hey, you could also expand it to other social networks, right? TikTok?"* (PT4).

Collaboration and Teamwork: Across the transmedia of the board game, through collaboration and teamwork, participants expressed that it was more effective and enjoyable to solve the challenges and learn, they also mentioned that by communicating, sharing knowledge, and combining their team's skills was easier to reach the correct answer and not get stuck. They also noted that these interactions made the learning process more engaging and social, as they could rely on each other's strengths to understand complex topics. The participants stated, *"It was easy to collaborate with others. It's better to collaborate than to play individually"*(PT1), *"I thought what made it difficult was the challenges. Because to collaborate with people, it wasn't..."* (PT3).

Language Barrier: The language barrier impacted the understanding of some financial terminology since these participants were native Portuguese speakers, a participant said *"I think the biggest challenge was my English"* (PT4). They felt that offering the game in their native language comprehension would improve as well as learning, in particular, a participant said *"I felt good. Maybe if it was in Portuguese I would feel better, I would feel secure [in their ability to read and play]"* (PT2).

Design: Participants praised the game’s design and visual style. It was seen as appealing and user-friendly, making it easier to understand the game, follow the story, and stay engaged throughout the gameplay. Some participants stated, “*What caught my attention, maybe the design, it’s appealing, it’s cool.*” (PT4), “*I think the design was intuitive*” (PT3).

5.2 Evaluation of Where’s the Finance?: Goldcrest Curse

This section describes the evaluation outcomes of the web game "Where’s the Finance?: Goldcrest Curse". After the difficulties in recruiting participants for the overall transmedia experience due to the extensive time that it takes to interact and evaluate all the different media channels, we decided to conduct a separate evaluation of the web game to allow for a more thorough analysis of this channel.

Specific research protocols and metrics (that included both quantitative and qualitative measures) and the detailed results of the study are discussed in the following subsections.

5.2.1 Protocol and Metrics

In this subsection, we will outline the steps we took to conduct the study and the measures we used to assess our findings. Our research design involved surveys, a web prototype to test, and a case study with semi-structured interviews, and the study was conducted in our research center. The protocol for this test can be seen in Appendix C

Participants were recruited using a convenience sample by asking colleagues to bring acquaintances to test the prototype; it is important to acknowledge that this may limit the generalization of our findings. The session started with the researcher introducing herself and explaining the study. Then, a consent form was presented, and any doubts were answered, the consent form is present in Appendix E. After that, the participants answered a pre-questionnaire with their demographic details (gender, age, profession, monthly salary, used financial-related resources), a self-report questionnaire, a financial attitude questionnaire, and finally, knowledge questions about the financial topics. The form for the pre-questionnaire can be seen in Appendix I, and the form for the post-questionnaire can be seen in Appendix G

Subsequently, the participant interacted with the game using a "Think Aloud" technique [57], and the researcher took notes throughout and only helped the participant if they could not move forward. Thereafter, the participant answered a post-questionnaire with the same questions as the

pre-questionnaire with the added segment of the Mini PXI questions, which measures the player experience as a multi-dimensional construct and dissects how players experience the game: at the functional level (audiovisual appeal, challenge, ease of control, clarity of goals, progress feedback) and a psychosocial level (autonomy, curiosity, immersion, mastery, meaning and an added construct by the authors, enjoyment). In the end, a semi-structured interview was conducted in Portuguese to accommodate the native language of the participants and make them more comfortable with giving better and more elaborate answers. The interview was recorded using a smartphone voice recording app to be later transcribed, figure 38 presents the questions asked. The study had a duration of approximately one hour and twenty minutes.

Did you learn any new financial strategies or concepts from the game?
What are your biggest frustrations or challenges related to financial literacy, mentioned during the game?
After playing the game, did you feel that there was any habit that you would change, related to financial topics?
How has this experience contributed to feeling more informed/aware of the financial topic?
Did you identify with any particular character in the game? If so, which one and why?
Did identifying with a character help you understand certain financial concepts better?
Do you intend to take any steps to improve your retirement planning after interacting with this character (Carlota)?

Figure. 38: Seven questions, used in the semi-structured interview after playing the web game prototype

5.2.2 Data Analysis

All statistical analyses described in this study were conducted using IBM SPSS version 28. The analysis involved a Likert scale which was modified from the previous Google Forms scale which was 1 to 7, to the normalized -3 to 3 scale following the scale. Due to the nature of the data measured and the small sample size, it is appropriate to apply a non-parametric statistical test. Therefore, we will be testing for the difference between two unrelated sample conditions by using the non-parametric Mann-Whitney U test. Differences between the scores in each of the conditions were considered statistically significant at $p < 0.05$. The overall Mini PXI scores were documented for every participant as well as the dimensions of Mini PXI, and also the self-report questions, knowledge questions, and financial attitude. With regards to qualitative data obtained from ob-

ervation and semi-structured interviews, thematic analysis [58] was employed to highlight and examine the themes encountered within the data.

Delving into the measures, as mentioned, we measured self-report, financial attitude, knowledge, and the Mini PXI constructs. We created our self-report questions concerning the financial topics used in the game and overall financial knowledge perception, as well as our knowledge questions since our topics were very specific. For the financial attitude questions, we followed Stella et al. way of measuring it [59], for engagement we used Mini PXI which measures the player experience as a multi-dimensional construct and dissects how players experience the game. The self-report questionnaire has five questions related to the financial topics of the games. Some of the questions are: "I am confident in my knowledge about financial literacy", "I am knowledgeable about creating and maintaining an emergency fund", "I understand the 50/30/20 budgeting system and how to apply it to my finances". The financial attitude questionnaire has eight questions created by Stella et al. [59]. Finally, the financial knowledge questions are based on the topics in the game (emergency fund, budgeting, expenses, retirement plans), there are twelve questions and we used the financial website to create the questions [?]. These three questionnaires were added for specific reasons the self-report enables getting a direct account of the participants' subjective experiences and perceptions. It is necessary to estimate their feelings concerning their level of knowledge and self-awareness. The financial attitude questionnaire engages the participants in seeking their opinions on their financial concepts and what they do with money. In a case where there is financial management, it is possible to measure the financial attitude and ascertain if the game is capable of changing the users' perspective as well as the mindset related to the strategies. Finally, the financial knowledge questionnaire measures the financial concepts that the participants possess both before and after playing the game. This will help us measure the financial knowledge acquired by the users.

We grouped our data into the main themes we discussed with the participants with the use of Taguette ¹⁷, a text tagging tool for qualitative data analysis.

5.2.3 Sample

In our study, we gathered 25 participants; the most prominent gender was male, with 14 individuals. The age range of the participants was 18 to 30 years old; the median age was 24 years old; (M=23.9,

¹⁷<https://www.taguette.org>

SD= 2.98). The most common occupation was "Student," with eight participants. Other professions to mention are "Brand Protection Data Analyst" (4 participants), "Developer" (2 participants), and various others like Skipper, Marine Biologist, etc. The employment status of these participants is mostly full-time (16 participants). The prevalent monthly salary answer was the range between 900€ and 1200€ (12 participants), eight participants answered 0€-310€ matching the number of students that do not receive a salary, four participants answered 1200€-1800€ and finally only one participant answered 600€-900€. Regarding the last demographic question, most participants reported never using any financial resource (10 participants), and the most used resource among the participants was "Financial podcasts" (8 participants).

5.2.4 Quantitative Results

The results of the Shapiro-Wilk test indicate that most of the Likert-scale data does not follow a normal distribution, as many of the p-values are below 0.05. Since most of the data fails the normality test, we used non-parametric tests (such as the Mann-Whitney U test, Kruskal-Wallis test, or Spearman's correlation)

The mean for the pre-questionnaire answers on Financial Attitude was 46.20 ($M = 46.20$, $SD = 5.809$); for the post-questionnaire, the mean was 48.92 ($M = 48.92$, $SD = 5.49$). Since our results were categorical, we used a non-parametric test for two related samples because of repeated measures, the Wilcoxon test evaluated the difference between the pre and post financial attitude. The test indicated that financial attitude was significantly higher post-questionnaire than pre-questionnaire, $z = [-3.146]$, $p = [0.002]$, $r = [-0.44]$ the sum of negative ranks was 30 and the sum of positive ranks was 223.

The median for the pre-questionnaire answers on Self-report was 18 (IQR 13-24), for the post-questionnaire the median was 25 (IQR 21.5-30). Since our results were categorical, we used a non-parametric test for two related samples because of repeated measures, the Wilcoxon test evaluated the difference between the pre and post self-report scores. The test indicated that the self-report score was significantly higher post-questionnaire than pre-questionnaire, $z = [-3.548]$, $p = [0.001]$, $r = [-0.5]$ the sum of negative ranks was 21.50 and the sum of positive ranks was 254.50.

The median for the pre-questionnaire answers on Knowledge was 7 (IQR 6-8.5), and for the post-questionnaire the median was 9 (IQR 7.5-10). The questions "Which of the following is a

common reason to use an emergency fund?", and "How do you categorize going out for dinner on a domestic budget?" had the most correct answers ($n=23$) on the pre-questionnaire, on the other hand, the question "What is the tax deduction rate when withdrawing from a PPR after more than 8 years?" had the most incorrect answers ($n=23$) on the pre-questionnaire. On the post-questionnaire the question "Which of the following is a common reason to use an emergency fund?" was the one with the most correct answers ($n=24$), and the question "You lose your job unexpectedly and need to cover your expenses for the next three months. Which financial strategy is most advisable if you have a well-established emergency fund?" was the one with most incorrect answers ($n=16$) here we can see that for this question the before and after numbers were the same, but for the "What is the tax deduction rate when withdrawing from a PPR after more than 8 years?" question there were now only 13 wrong answers. Since our results were categorical, we used a non-parametric test for two related samples because of repeated measures, the Wilcoxon test evaluated the difference between the pre and post knowledge. The test indicated that the knowledge score was significantly higher post-questionnaire than pre-questionnaire, $z = [-3.181]$, $p = [0.001]$, $r = [-0.45]$ the sum of negative ranks was 20.50 and the sum of positive ranks was 189.50.

The highest score in the Mini PXI was 33 and the lowest was 7, the mean of the scores was 22.32 ($M = 22.32$, $SD = 6.86$). Figure 39 is a histogram that shows the Mini PXI questionnaire scores for each of the participant's scores and Figure 40 shows boxplots for each of the Mini PXI constructs. To test normality we used the Shapiro-Wilk test; since all significance values were less than 0.05, we concluded that there was no normality. With it not being normal, we used non-parametric measures to analyze potential correlations; Spearman's Rho was the chosen test. We will delve into the significant correlations observed between the constructs within the Mini PXI questionnaire, these correlations offer valuable insights into various elements contributing to player engagement and satisfaction.

A Spearman correlation on the feedback and mastery constructs correlated strongly and positively with $\rho=0.566$, $N=25$, $p<0.01$. This hints that giving players well-designed and useful feedback can increase their mastery. Feedback can provide an effective way for players to know how they are progressing, what areas need development, and thus where improvement is required, but also allows them to celebrate their achievements which encourages a higher sense of accomplishment.

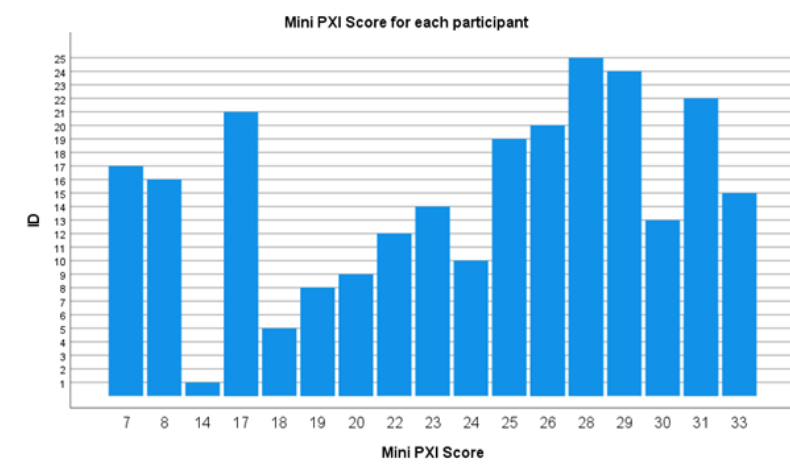


Figure. 39: Histogram shows the results on the Mini PXI questionnaire for each participant

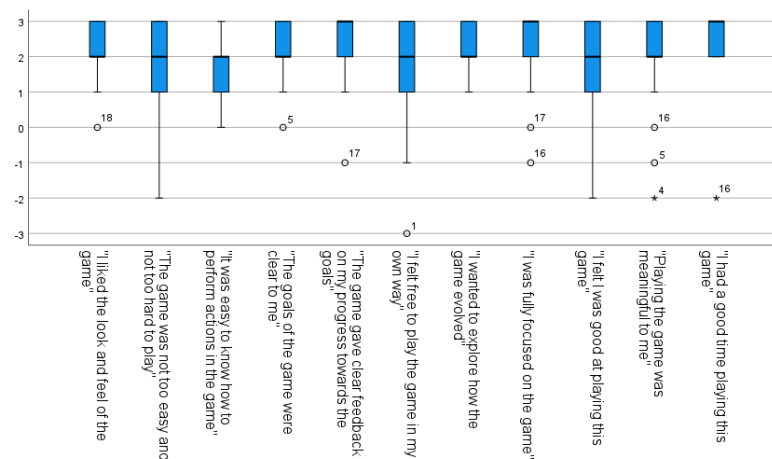


Figure. 40: Boxplot distributions for Mini PXI constructs for the Web game (n=25). On the X-axis we can see the questions and on the Y-axis we can see the score

A Spearman correlation on the autonomy and meaning constructs correlated moderately and positively with $\rho=0.514$, $N=25$, $p<0.01$. It is interesting to see that players who perceived more ability to choose how to play were also more likely to say they found the game meaningful. Empowering the player to make choices that shape the story can also help create a stronger bond or engagement with the world of a game.

A Spearman correlation on the immersion and mastery constructs correlated strongly and positively with $\rho=0.628$, $N=25$, $p<0.001$. Intriguingly, the more deeply the player is integrated into the virtual world, the better their sense of mastery.

A Spearman correlation on the meaning and mastery constructs correlated strongly and positively with $\rho=0.662$, $N=25$, $p<0.001$. It suggests that when people perceive a game as meaningful and having some impact on them, they are more likely to work on understanding it in depth.

Finally, a Spearman correlation on the meaningfulness and enjoyment constructs correlated moderately and positively with $\rho=0.557$, $N=25$, $p<0.01$. It suggests that the more meaningful a game is to the players, the more likely it will also be enjoyable. By making the game themes, characters, or game mechanics meaningful to the player the more likely he is to have a satisfying experience.

5.2.5 Qualitative Results

From our semi-structured interview recordings, we gathered qualitative feedback about our prototype. We grouped our data into the main themes we discussed with the participants. The following overview displays the analysis we did.

Financial Knowledge and Learning: Participants demonstrated a strong interest in learning financial concepts before using the prototype, for example, *"I already consider a lot of these things about saving money, especially the parts about percentages"* (P11), many noting their enhanced understanding of topics like budgeting, investments, and retirement planning. Even though they did not know about these topics beforehand, they talked about the 50-30-20 rule and different retirement plans (PPRs), highlighting how these insights could be integrated into their financial strategies, for instance, *"Yes, I learned a lot about the 50, 30, 20 rule."* (P3). The game clarified previously unfamiliar concepts, and its interactive format made it easier for participants to understand these ideas and recognize their real-world applications, one participant said *"I didn't realize the difference between the PPRs, that one is insurance and the other is a fund"* (P10).

Current and Future Financial Habits: Participants shared their current financial habits and what they plan to change, some had established habits, and others said they were terrible at budgeting and had a hard time with impulse buys and saving regularly, for example, some said, *"Yes, that about saving more. Actually, the percentages help a lot [referring to the 50-30-20 percentage rule]"* (P23). The game made many reflect on areas for improvement, especially building financial safety nets and long-term goals like retirement, for example, *"I feel like I could save more*

for my emergency saving" (P10), "I will think about the PPR. Because those tax deductions are cool" (P14).

Engagement and User Experience: The game's design and aesthetics were generally well-received, with participants noting that it made financial topics more approachable, for instance, "The image is super appealing to learning something [referring to the whole aesthetic of the game]" (P23). The visual and interactive aspects, combined with storytelling elements, made the learning experience enjoyable, a participant said "I liked the little characters in the more practical part" (P11). They appreciated the aesthetic and the game's balance of visual and textual information, which kept them engaged and motivated to continue learning. The participants said, to illustrate we have this quote "I found the QR code part very funny" (P8).

Challenges and Frustrations: Participants found difficulties like language barriers because the game was in English and complex topics like PPRs, for example, "I think my biggest challenge was the English really" (P4). While the game made financial learning more accessible, some felt overwhelmed by the amount of information or struggled with specific terms and concepts, for example, "I think there was too much information on the PPR paper and I didn't know where to look" (P13). These frustrations often pointed out areas where the game could provide more support or clearer explanations. Some participants also felt frustrated by not doing well while playing "The frustrations were with me, didn't have anything to do with the financial part [the participant felt frustrated with himself because he could not find the characters]" (P16).

Character Identification and Personal Reflection: The participants frequently identified with characters or scenarios in the game, for instance, "I am like Maria. I like to buy things I don't really need" (P15). This helped them relate to the financial concepts being presented, by relating to them it made it easier for them to remember and apply what they learned in the game, some participants said "For example, now Maria the one from the budget [topic] is the most relatable" (P12), "Yes, because in the end you identifying with the character helps understand" (P7),

Desire for More Knowledge and Gameplay: Many participants expressed an eagerness to delve deeper into the game, they wanted to play more levels, and more information on topics like investments and retirement plans to enhance their understanding even further, one example would be P2 "I would like to go to my bank for them to explain better to me the PPR". This desire for

additional content indicates that the game successfully piqued their interest and interest to learn more about this abstract topic which is financial literacy.

Financial Perception and Attitudes: Players shared ideas about their financial proficiency and habits, their responses range from feeling intelligent, such as *"I think I have good financial habits"* (P19), to acknowledging a useful breakthrough in their understanding. Most participants felt unknowledgeable about the topic, for instance, *"I know almost nothing about financial literacy"* (P15). However, we could see that they were open to learning about it and to fill those gaps.

Taboo Topic: Financial topics, especially those related to personal savings, risk-taking, and long-term planning, were considered somewhat taboo by some participants. There was a sense that these topics were not often discussed openly, which created barriers to learning and engagement. One example is this participant who said, *"Definitely. It has to be us too, to talk about this and take risks"* (P9).

Lack of Focus in Retirement Planning: Retirement planning was a recurrent theme, also correlated with the fact that one of the levels was about this topic, with participants discussing their current lack of focus on it and their plans for future savings. Many noted that the game provided a push to start thinking about retirement earlier than they might have otherwise. Some participants said, *"I never thought about saving money for retirement, or that retirement plans existed for younger people"* (P5), *"Oh yes, start. Yes, I think it wasn't something I thought about before and I also didn't know that we could be thinking about it so soon. So I think this game opened my eyes to that and it might even be a consideration that I will have"* (P24), *"Yes. Planning retirement, naturally, because I never thought about it. Yes, and with these plans I already have a small idea of what I can do. It's a good start, to invest in this"* (P22). However we also saw some younger participants that did not have the same eagerness to create a retirement savings account, some examples are, *"Not in a few years, in about 10 years I'll start thinking about it"* (P4), *"No, not for now. I still don't want to think about it. I have other more important things for now. Hopefully in the future"*, *"At 40, around that, or 30, 30 and something or 40"* (P1).

Closer to the Character and Game Elements: There are narrative components in the game such as using characters and storytelling to convey the message about financial literacy which the participants found useful in generating interest concerning the topic of finance, making it more accessible. We can quote some examples, *"They all have stories that anyone can relate to"*

(P25), *"And also, that's it, the story helps to understand how a person has their investment plan, what their expenses are like"* (P8). Participants also enjoyed the Instagram game mechanic, one example is *"I thought the QR codes part was funny. I thought the idea was funny too, the map. I also found the game challenging, it's not too easy, which is also something that takes the fun out of the games. I think the design is also simple and not too complex, it suits the game"* (P8).

Important Theme Awareness: All discussed the importance of financial literacy as a necessary life skill that is too often either overlooked or brushed to the side, our game emphasized concepts about how to be financially literate like budget, savings, and investment. Participants also indicated that financial education was important for managing day-to-day spending, and planning for the future to save money in retirement and save their wealth, for instance, *"Because this is something that I always like to learn, I think it is important to learn how to manage money."* (P10). Through these topics, players learned that planning was not only for the wealthy or elderly and that it went hand in hand with personal development. This was a sentiment shared by some of the participants, *"I think we all need to learn to manage money well. I think the more you can save, the better. Because you don't know what will happen tomorrow."* (P11), *"Yes, it contributes a lot. Because... now that we're starting, right? So, we are still young and we have to start thinking."* (P15).

6 Discussion

We sought to answer the research questions presented at the beginning of this dissertation. In this section we start by addressing each of our research questions, then we reflect on the process of designing a transmedia storytelling experience, and, towards the end, we recognize some limitations and discuss future work related to our research.

6.1 RQ1: Does a transmedia storytelling experience contribute to an increase of knowledge of financial literacy topics among young adults?

Data from the first pilot studies indicated a low financial literacy knowledge. However, they showed a strong preference for web and board games as teaching methods. This preference was confirmed in our study, where participants found both the digital and physical components of the transmedia approach engaging and effective in enhancing their financial knowledge. The increase in post-test scores reflects this, demonstrating the effectiveness of combining multiple platforms to create a more immersive learning experience.

To evaluate whether our prototypes contributed to knowledge gain, we asked participants to answer pre and post-questionnaires about the financial topics present in the game. The results showed a significant increase in correct responses in the post-questionnaires, suggesting that the interactive and multi-platform nature of transmedia storytelling effectively facilitated learning. For example, participants' performance in financial knowledge questionnaires improved from a median pre-test score of 7 to a median post-test score of 9. This increase indicates that the transmedia approach helped reinforce and deepen their understanding of financial concepts. The qualitative and quantitative results from the whole transmedia experience showed positive results in the engagement component as well as a gained interest in the topic. This aligns with research by Klontz et al. [39], which emphasized the value of psychoeducational interventions in improving financial competence. It also aligns with studies on transmedia storytelling by Jenkins [10], where knowledge is scattered across various media, promoting a deeper and more distributed understanding. The narrative context, which revolved around relatable financial dilemmas, turned very abstract financial concepts into real-world scenarios, aiding in knowledge retention. The web game presented an engaging and active setting where players could practice various financial concepts such as emergency funds, budgeting, and retirement savings plans, by making actual decisions in real-time,

therefore we can see that financial attitude, self-report, and knowledge were significantly higher post-questionnaire than pre-questionnaire. The Mini PXI answers also indicate significant positive values in engagement, players acted out interactive scenarios with their choices, motivating practice and experience. Based on the qualitative data we encountered for the transmedia experience test, the web game structure provides adjustable levels of difficulty, allowing the users to be appropriately challenged at all times. The social feature of the game acted to make the community more active and continue engaging with each other, it brought the complete learning experience one step further and provided excellent interaction. The platform also provided opportunities for social learning where participants were able to interact with their peers and share ideas, raise questions, and explore the ideas of their colleagues and the overall strategies of the finance field. The board game gave the participants a collaborative and hands-on approach to learning, it made it possible for the audience to interact face-to-face and make group decisions about finances, what could be termed as a social aspect, which facilitated the dialogues dealing with financial matters as well as problem-solving. The board game's comparatively slower pace gameplay brought about a chance to consider the financial learning materials more deeply which built up the knowledge acquired through the digital game. This hands-on interaction enhanced the overall digital experience adding another dimension of learning that appeals to various learning styles but added to the entire story of financial literacy. The focus on social interaction implies the potential for integrating collaborative gameplay into financial education; however, this was not entirely anticipated in the initial design of the study. Additionally, it was discovered that participants exhibited a strong preference for engaging with the game in the long term. This suggests that financial literacy ought to be viewed as a continuous process, rather than merely a singular lesson since it requires consistent effort. We saw that the topics we chose were highly regarded because they made the participants reflect on their own lives, many said that they want to save more in the future and also want to create a retirement savings plan or learn more about it in their local bank.

Despite the positive outcomes, there were areas for improvement. The addition of more financial content, in the web game, as requested by the users would be beneficial. On the other hand, for the board game, many users reported that the concepts in the challenge cards oftentimes were very difficult to overcome and understand the financial content.

6.2 RQ2: How effective are gamified approaches in increasing financial literacy engagement among young adults, and what specific game elements most significantly impact learning outcomes?

To test how engaging our experience was we used the Mini PXI to measure player's experience, both the web game and the board game received high scores in engagement metrics such as curiosity, immersion, and meaning. Participants expressed that the games, especially when designed with interactive elements like storytelling, and visual rewards, made the experience enjoyable and less intimidating, which is crucial when dealing with a complex topic like finance. All in all, the findings of the study suggest that immersive experiences can significantly increase engagement among young adults in learning financial literacy. The use of transmedia storytelling, as proposed by Jenkins [10], allowed for a seamless transition across media, which enhanced participant immersion. This finding is consistent with the broader literature on transmedia's capacity to engage learners by dispersing content across multiple platforms, which encourages deeper participation and engagement [20].

It is also relevant to mention some findings about specific game elements that significantly impacted learning outcomes, one was the strong preference for collaborative learning, as seen in the success of the board game component, they expressed a high level of satisfaction with the team-based challenges, particularly the drawing and forbidden words challenges, which encouraged discussion and collaboration. This diverges from some forms of literature that suggest that individual learning experiences tend to be more effective for retaining knowledge in complex subjects like finance [45]. Regarding the web game players enjoyed the score element because it promoted competition. Additionally, they mentioned that retirement savings plans was the topic they learned more about because they had to read it several times, showing that financial literacy needs a lot of repetition to be learned.

6.3 RQ3: How does the use of narrative and storytelling elements in an interactive experience engage young adults on financial literacy topics?

The integration of narrative elements was a key aspect of the study's design, and the results suggest that narrative-based learning is highly effective in engaging participants, the results are discussed in the qualitative results where the participants mention the storytelling elements. Participants

felt that it helped make financial concepts more relatable and easier to understand as well as connect on a personal level with the content, a participant said *“It had an impact for the simple fact that each story represented a different person and that person had their own needs.”* (PT1). In both games, narrative played a central role in the experience, the web game used a "braided narrative" to connect the financial struggles of five main characters, which allowed participants to explore financial dilemmas within a broader story. This approach not only contextualized abstract financial concepts but also made them relatable to the participants, as demonstrated in their positive feedback about the story-driven gameplay. Participants felt that this approach made the learning more meaningful since they could see the implications of poor financial decisions in the characters' lives, for example, *“That’s why the story, the story of the characters, is impactful so that you understand the knowledge.”* (PT4).

Participants commented on how the characters' stories and the challenges they faced (e.g., budgeting dilemmas, debt issues, savings goals) helped them reflect on their own financial decisions. This reinforces the idea that stories can provide a bridge between theoretical knowledge and practical application, an idea strongly supported by previous studies in transmedia and education [44] [43]. Moreover, the participants' suggestion to expand the transmedia world (e.g., adding a complementary mobile app or extending the narrative across more platforms like TikTok) indicates a desire for deeper engagement with the content through storytelling.

6.4 Reflections on the process of designing a transmedia storytelling experience

The workshop conducted in early iterations (see Section 3) allowed for significant decisions, such as deciding on which financial topics were more relevant for our target audience, in the creation of the games as well as its themes, while ensuring that educational objectives were met. Early tests revealed that certain interface elements, particularly in the web game, could be optimized to enhance user interaction and retention of financial concepts. Participants found some features confusing, such as the user interface or how the board game design did not match the web game. These insights guided the redesign of the user interface and experience, resulting in a more accessible and intuitive system.

The first tests we conducted (see Subsection 3.2) helped us determine what type of media was more suitable to disseminate this topic and for this target audience. With these initial tests, we concluded that the web and the board game were promising media to use, from there we started creating the transmedia experience hand in hand with the web game and also the Instagram page. These media were crucial in making the experience not only educational but also enjoyable for users.

The subsequent iterations (see Subsection 4.6.2) focused primarily on identifying key areas of improvement in usability, particularly around how players interacted with financial concepts presented through the game mechanics. The feedback from the tests included positive feedback on design like graphic elements, color palette, and overall aesthetic; some participants expressed frustration in trying to sort through when to find the object and when to find the character; the Instagram component was very appreciated by the participants, they liked how it integrated with the game for providing additional context and engagement. It became evident that the process of finding the character and the object needed clarification and simplification. This stage also provided an opportunity to introduce new features, such as gamification elements, including badges and rewards, which were suggested by participants to increase motivation and engagement.

The final evaluation of the transmedia experience, conducted with participants from various backgrounds was divided into two, one for the web game (see Section 5.2), and one for the board game (see Section 5.1), both yielding positive feedback. Not only did participants engage fully with the experience across all platforms —web game, board game, and social media— but they also demonstrated an improvement in their financial literacy. Additionally, none of the participants encountered significant bugs or issues during the final testing phase, making us believe that the game was ready for the final implementation. The participants were able to navigate and interact with the transmedia elements with minimal guidance, indicating that the improvements made during earlier stages were successful, showing how important this iteration process is.

6.5 Limitations and Future Work

It is important to recognize certain limitations that may have influenced the overall outcomes. The small sample size is one limitation (particularly during the transmedia evaluation phase), where only four participants participated in the study. The recruitment process may further restrict the generalization of our results; given the length and scope of the test, it is challenging to gather

participants and ensure that everyone is available to play the team-based game at the same time. A larger sample would have more reliable data, thereby providing a better understanding of how diverse groups might respond to the experience. In future studies, we want to recruit a wider range of participants because this would ensure the findings are more representative and deliver a comprehensive picture of the effectiveness of transmedia storytelling in financial education. However, the current limitations do not diminish the potential of this innovative approach.

Another limitation is the fact that the participants interacted with all media of the transmedia experience on the same day. Although this way of testing facilitated a controlled environment to gather feedback, it failed to create a natural way of interacting with the transmedia. Most of the time transmedia content is dispersed, where users engage with the diverse media at their own pace, the compressed format we used in the study may have influenced how participants retained the financial concepts because they did not have the opportunity to reflect on each medium individually. In the future it would be beneficial to let the users engage with the different components over a prolonged period, resembling the real-world usage and we could better comprehend how the transmedia shapes knowledge and behavior.

One further limitation is the use of merely three media platforms. Even though the use of the web game, the board game, and social media proved to be effective, many times transmedia storytelling flourishes with a broader utilization of platforms. This expansion could enhance the overall experience, and maintain the users in the long run. Future iterations might explore the use of podcasts, mobile applications, video content, and augmented reality or virtual reality.

In the future, some opportunities emerge from this study, such as investigating the long-term effects of transmedia storytelling on financial literacy. Although participants showed heightened confidence in their financial knowledge after engaging with the experience, it is unclear how long this knowledge will remain and if it will influence their financial behaviors over time. Future research could concentrate on following participants for several months after their initial engagement with the experience and verify whether they retain the information and apply it in real-life financial decisions. In the future we would also like to have a translated version of our game, to accommodate the language barrier felt by some of our participants. Other future opportunities would be to delve deeper into a ranking system in the web game, from our test we could see that the participants kept track of their scores to compare with the other participants. For example, integrating a leaderboard that allows users to engage in real-time competition against their peers. Finally, another future

opportunity would be to incorporate additional levels and characters, each of them focusing on a specific financial scenario. Future adaptations could broaden the narrow array of financial topics such as investment strategies or tax management.

7 Conclusion

In conclusion, this dissertation was intended to investigate the efficacy of transmedia storytelling methods aimed at developing financial knowledge and skills among the youth. The findings support the view that combining financial literacy with transmedia storytelling can be an ideal way to better learning absorption. Transmedia storytelling, as presented in this dissertation, provides an effective way of conveying financial literacy by building a story on different media. This model takes the learners through the narrative and enables them to grasp the financial ideas in a more integrated and meaningful way. Moreover, it enhances learning through different media channels such as Instagram where there is mainly imagery content for the visual learners, as well as interactive elements in web gaming activities for those who are active learners. Furthermore, transmedia storytelling takes advantage of the power of repetition to enhance the learning of the target audience, with financial literacy experience spread across numerous channels, there is an opportunity for reinforcement as it seeks to help the user retain the ideas presented. The different media channels entertained participants, who became more self-assured about their knowledge of finances after interacting with each media format. Using narratives as a learning tool, in this case, to narrate the financial troubles of ordinary people, served the participants vividly and helped them to learn financial literacy by stressing people's concerns rather than statistics; this is coherent with other trends common in transmedia storytelling where narratives are incorporated into learning experiences as research shows that such multi-platform captivity improves engagement and learning as opposed to traditional methods.

Nonetheless, while the benefits of this experimental approach are commendable, the boundaries of the research present several limitations that warrant further study. It is still unknown how the transmedia experience would fare in a more natural state, with participants consuming content over a long time and at their own pace. Likewise, although limiting it to only three media platforms proved beneficial in many ways, it may not be the most efficient way of exploiting the essence of transmedia storytelling. More research should look towards increasing the variety of media and presenting it more freely to the users to enhance and extend learning.

From this perspective, this work could be continued further. One direction worth following is examining whether or not transmedia storytelling influences people's financial literacy and related behavior in the long term. In this way, we could understand more comprehensively the long-term

effect of these educational experiences on users. Moreover, further developing the ranking system features could be very useful in providing the users with more personalized and competitive learning experiences while widening the content provision to a wider range of financial domains would enhance proper education for users.

We hope our research and this dissertation will motivate and provide useful insights for future works. However, we understand that this is a first step towards exploring the possibilities offered by transmedia storytelling and gamified experiences, and within the limits we have sketched above, we urge further exploration.

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A Appendix A - Co-design Protocol

This document shows the protocol created for the Co-design Workshop to access current challenges and problematic themes within financial literacy

Co-Design Session Protocol

Researchers/Responsible for conducting the activity: Ana Santos, Constança Freitas

Objectives:

1. Collect qualitative data that allows for mapping the current necessities and challenges that financial literacy poses to young adults.
2. Work collaboratively to identify and prioritize the most problematic themes and challenges within financial literacy.
3. Encourage participants to brainstorm potential solutions, strategies, and interventions to address the identified problems.
4. Foster collaboration and co-creation among participants to tap into their collective knowledge and experience.

Participants: Master's students at the University of Madeira.

Length: One hour per group

Location: Rooms 8 and 9 @ ITI/ARDITI

Materials/Resources:

- Virtual: presentation, TV, recording software, note-taking software (Miro)
- In person: Consent forms.

Roles:

- Ana Santos: Moderator, note taker, recorder.
- Constança Freitas: Moderator, note taker, recorder.

Introduction to Session

Hello, my name is ___ and I am an Interactive Media Design/Informatic Engineering Master's student here at the University of Madeira developing my thesis on financial literacy. Today we will do a co-design workshop because we are hoping to further understand your knowledge, opinions, and concerns about finances.

Thank you in advance, for taking this time to help us with our master's thesis.

We will be recording the audio of this session only for note-taking purposes; we will transcribe the audio and delete the audio. The transcription will be anonymized meaning that any personal or intimate data will be erased so as to not compromise your identity.

We will also might take photos of the activity or use screenshots of the work done digitally. In both cases, the images will be anonymized. Considering that we might use this in our master's thesis, you have this informed consent form on how your data is protected.

PRE-ACTIVITIES

- Constança and Ana join the PMS server - Invite <https://discord.gg/Jv3mFqcM>
- Public channel for workshop, in case Constança and Ana need to communicate with the students
- Discord announcement about the workshop (Paulo will do this).
 - Miro links will be available before the workshop so that they can upload their collected data (e.g. screenshots, photos, etc.)
 - Directions to get to floor -2
 - Information needed for wifi access in ITI/ARDITI
- Constança and Ana will print required materials (like consent forms) - either at CCIF (IP in Notion) or at ITI (print instructions in Notion)
- For each participant, you need 2 consent forms. One will be signed by the researcher and the participant; the other is kept by the participant.
- Constança and Ana will set up each Miro. Make sure that the start view of the Miro is not too zoomed in.
- Miro links will be posted on their private channels on Sunday/Monday by Paulo
- Ask that at least two members of the team bring a laptop so that they can access Miro. If not possible, Constança and Ana will have one laptop available.
- If they don't bring their data, using the Miro app you can take a photo and directly insert it into the board (the photo might be large due to phone quality). I don't think this is a pro feature, but test it out first. If it's a pro feature, the eGames notion has some instructions on getting a student account for Miro.

DISCORD MESSAGE

Boa noite, mudança de planos em relação a próxima aula de TP.

A Ana Santos e Constança Freitas são duas alunas de mestrado que estão a trabalhar em teses sobre financial literacy para jovens adultos.

Como vocês estão numa fase em que estão a analisar as vossas etnografias e a começar a ideação para a fase de análise e desenho, a Ana e a Constança vão usar a aula TP para fazer um workshop de co-design, que irá fazer parte da tese.

Na próxima semana irei colocar um board de Miro para cada equipa no vosso canal privado, onde poderão fazer o upload do vosso tracking financeiro (eg., scans, fotos, screenshots, etc.). Durante o workshop, a Ana e a Constança vão vos conduzir por um processo de reflexão e ideação.

Para cada equipa, este processo irá demorar cerca de uma hora, e como só temos duas facilitadoras, iremos dividir a turma: grupo 1 e grupo 2 fazem o workshop às 11, grupo 3 e 4 fazem o workshop às 12.

Devido a falta de espaço na sala 30, iremos fazer isto no piso -2 do Tecnopolo. Para quem nunca lá foi, a UMa e o Tecnopolo estão ligadas por um corredor com o departamento de Biologia/Química e com os assuntos académicos. Ao entrar no Tecnopolo, tem um elevador (e escadas) que vos levam ao piso -2. Os workshops serão na sala 8 e 9, que são a meio de um corredor de chão vermelho.

Se possível, cada grupo deverá trazer um ou dois portáteis para poderem interagir com o Miro; também é possível utilizar através de telemóveis e tablets embora a interação seja mais difícil. Podem usar Wi-Fi, através da rede Eduroam; caso não esteja a funcionar, a Ana e a Constança tem uma rede alternativa.

Se tiverem alguma pergunta ou se precisarem de indicações no dia, a Ana e a Constança irão juntar-se a este Discord em breve.

Activities

Activities	Purpose	Materials	Time
Introduction of the workshop <ul style="list-style-type: none"> • Welcome • Open Miro on your computers and enter the following board • Read and understand the visuals of the activities. 	Explain how the workshop will take place, by using the miro to show the visuals. Present the tools to participate in the workshop.	Miro.	5 minutes
Individual Reflexion <ul style="list-style-type: none"> • Answer some questions, previously stated in miro, about the autoethnography. 	Some questions about their autoethnography will be previously stated in Miro for the students to answer them.	Miro.	5 min
Group activity - Phase 1	Create a hierarchy to better understand	Miro.	6 min

<ul style="list-style-type: none"> • Discussion and creation of a hierarchy with the topics from the previously done autoethnography, justifying it. 	<p>what is more important/concerning /difficult/ ... , for these students.</p>		
<p>Group Division</p> <ul style="list-style-type: none"> • Divide the group of 7 or 8 people into groups of 3 or 4 people. 	<p>The groups will be divided in order to facilitate the distribution of tasks and to collect extra data.</p>	<p>Miro.</p>	<p>1 min</p>
<p>Group activity - Phase 2</p> <ul style="list-style-type: none"> • Each group will create a persona, taking into consideration the first element of the hierarchy. 	<p>The creation of a persona makes it easier to understand the user's needs and how to design a solution for the near future.</p>	<p>Miro.</p>	<p>16 min</p>
<p>Group activity - Phase 3</p> <ul style="list-style-type: none"> • From that persona, each group is intended to create a scenario where they explain the chosen problem and find a solution for it. 	<p>After creating the persona each group will collaborate between the members in order to develop a scenario where they will explain the problem choosed, taking in consideration the previous theme selected based in the hierarchy, and develop a solution for it.</p>	<p>Miro.</p>	<p>10min</p>

<p>Workshop Conclusion</p> <ul style="list-style-type: none"> ● Group 1 and 2 presentation of the results previously gathered. ● Each Group will have 4 minutes to receive and answer questions. 	<p>Once the scenario is created each group will be requested to present the idea, containing the persona, scenario, problem and solution and explain why and how that result was achieved.</p>	<p>Miro.</p>	<p>2 min for each group presentation. 5 min for each group questions. Total of 14 minutes</p>
<p>Farewell</p> <ul style="list-style-type: none"> ● To thank for the collaboration and participation in the workshop. 	<p>The responsables for the workshop will thank the students present for collaborating and participating in the study.</p>	<p>Miro.</p>	<p>1min 2min-leave the room and new participants enter</p>

B Appendix B - Transmedia Experience Protocol

This document shows the protocol created for the testing session of the transmedia experience

"Where's the Finance" which combined the web game, the board game, and the Instagram page

“Where’s the Finance” Testing Session Protocol

Researcher responsible for conducting the activity: Constança Freitas

Objectives:

1. Collect qualitative data to see if the use of different media impacts the users in any way.
2. Understand if the use of social media is significant or not in the learning of financial literacy and if it is engaging.
3. Test the two games.
4. Test the mechanics, rewards, and gameplay to see what works best.
5. Test the overall transmedia experience.
6. Encourage participants to brainstorm potential solutions, strategies, and interventions to address the identified problems.
7. Foster collaboration among participants to tap into their collective knowledge and experience.
8. Gather feedback on the participants’ likes and dislikes about the games.

Participants: Young adults, with ages between 18-30 years old.

Length: 2 hours and 20 minutes per group.

Location: CCIF

Materials/Resources:

- Virtual: Researchers computer, personal users phone, Google forms
- In person: Consent forms, Board game

Roles:

- Constança Freitas: Moderator, note taker.

Introduction to Session

Hello, my name is Constança Freitas and I am an Interactive Media Design Master’s student at the University of Madeira developing my thesis on financial literacy. Today I will do a study in order to evaluate a transmedia experience and its potential in teaching financial literacy. This transmedia consists of 3 media, a board game, a web game, and a social media page.

I am hoping to understand your opinion if they are efficient in teaching about financial literacy topics, budgeting, and savings, and also if they are entertaining.

I will take some notes about this session; the notes taken will be anonymized meaning that any personal or intimate data will be erased to ensure confidentiality of your identity. It's important to emphasize that these notes are focused on gathering honest feedback about the mechanics and prototype, and they will not, at any moment, evaluate or make any judgments about any individual performance as a player, the objective is only to get an honest opinion about the prototype to improve it.

Considering that we might use this in our master's thesis, you have this informed consent form on how your data is protected.

Thank you in advance, for taking this time to help with my master's thesis.

Activities

Activities	Purpose	Materials	Time
Introduction of the study <ul style="list-style-type: none"> ● Welcome ● Explanation of the study objective ● Consent form 	Explain how the study will occur. There will be a consent form requesting the user's consent to take part in the study. Present the tools to participate in the study.	Google forms Webgame (Unity) Instagram Board Game Personal users phone Researchers Computer	15min
Pre-Questionnaire <ul style="list-style-type: none"> ● Pre-questionnaire form ● Financial literacy questions 	At the beginning of the pre-questionnaire, some information about the study will appear, following this the user will answer questions about his demographic details, and some financial literacy questions.	Google Forms Researchers Computer	10min
Prototype Individual Experience <ul style="list-style-type: none"> ● The participant will play the "Where's the Finance: The 	The participant will play the web prototype game, with	Researcher's Computer Personal user's phone Google form	35min

<p>Goldcrest Curse” prototype, and visit the @goldensonGoldcrest Instagram page, and test the mechanics.</p>	<p>the objective of finding five characters hidden in the map. During the gameplay, there will be clues to help the user, starting with only one unlocked. To unlock the others the player will be asked to scan a QR code or follow a link to an Instagram page, where the user will see a close-up of the map with an object. To continue the user has to find this object on the map. (The user will not be given instructions, having to figure out the next steps on their own.)</p>	<p>pos-questionnaire:</p>	
<p>Pos-Questionnaire</p> <ul style="list-style-type: none"> ● Pos-questionnaire form ● Financial literacy questions ● Game experience questionnaire about web game 	<p>After finishing the gameplay, the user will answer the same knowledge questionnaire. And a game experience questionnaire.</p>	<p>Google Forms Researchers Computer</p>	<p>15min</p>
<p>Prototype Group Experience</p> <ul style="list-style-type: none"> ● The participant will play the “Where’s the Finance: The Comeback” prototype and test the mechanics. 	<p>The participant will play the board game prototype with other 3 people, making 2 teams of 2 participants. There will be written rules, and the moderator will not intervene. In this game, each team needs to collect 4 steps to win the game, the fastest wins.</p>	<p>Researchers Computer Board game Google form pos-questionnaire:</p>	<p>20min</p>

	After finishing the gameplay, each user will answer a questionnaire.		
Pos-Questionnaire <ul style="list-style-type: none"> • Pos-questionnaire form • Financial literacy questions • Game experience questionnaire about board game 	After finishing the gameplay, the user will answer the same knowledge questionnaire. And a game experience questionnaire.	Google Forms Researchers Computer	15min
Final Interview	Interview with each player in group, the players will answer some questions about the overall transmedia experience.	Researchers Computer	40min

ESCALAS:

- Website todos contam para perguntas de knowledge (e já tenho artigos a dizer o porque de escolher savings and budgeting - link: <https://www.todoscontam.pt/>)
- https://playerexperienceinventory.org/en_m para game experience
- Sobre Transmedia (tirar daqui uma escala de narrativa talvez, e procurar perguntas para as interviews) -
 - Narrative Transportation Scale (da Melanie Green) https://www.mcm.uni-wuerzburg.de/fileadmin/06110300/user_upload/Publikationen/Appel-Gnambs-Richter-Green-TS-SF-PREPRINT.pdf
 - Neste documento mais no fim tem algumas perguntas para **entrevistas**: <https://hal.science/hal-02139818/document>
 - ver se tem ideias de avaliar de avaliar experiencias https://www.tandfonline.com/doi/abs/10.1080/02560046.2013.766977?casa_token=IR1cioEmZ3kAAAAA:E0bltwg7xADSstPCeeJrbHX4DHzomBjbh7xW6ryo2XVjymq0Rvb67x6HvF0Oz3aqT7fzLjQctAyDeA
 - desenvolvimento duma escala (pag 4) posso usar isto como uma base para adaptar aos meus conteudos de financial Literacy <https://www.mdpi.com/2071-1050/12/8/3204>

C Appendix C - Web Game Protocol

This document shows the protocol created for the testing session of the web game "Where's the Finance: Goldcrest Curse"

“Where’s the Finance: Goldcrest Curse” Testing Session

Protocol

Researcher responsible for conducting the activity: Constança Freitas

Objectives:

1. Collect qualitative data to see how the web game impacts the users in any way.
2. Understand if the use of social media is significant or not in the learning of financial literacy and if it is engaging.
3. Test the game.
4. Test the mechanics, rewards, and gameplay to see what works best.
5. Encourage participants to brainstorm potential solutions, strategies, and interventions to address the identified problems.
6. Foster collaboration among participants to tap into their collective knowledge and experience.
7. Gather feedback on the participants’ likes and dislikes about the game.

Participants: Young adults, with ages between 18-30 years old.

Length: 1 hour and 20 minutes per group.

Location: CCIF

Materials/Resources:

- Virtual: Researchers computer, personal users phone, Google forms
- In person: Consent forms

Roles:

- Constança Freitas: Moderator, note taker.

Introduction to Session

Hello, my name is Constança Freitas and I am an Interactive Media Design Master’s student at the University of Madeira developing my thesis on financial literacy. Today I will do a study in order to evaluate a web game and its potential in teaching financial literacy. This game consists in 3 levels plus a tutorial level, and also an Instagram page.

I am hoping to understand your opinion if they are efficient in teaching about financial literacy topics, budgeting, and savings, and also if they are entertaining.

I will take some notes about this session; the notes taken will be anonymized meaning that any personal or intimate data will be erased to ensure confidentiality of your identity. It's important to emphasize that these notes are focused on gathering honest feedback about the mechanics and prototype, and they will not, at any moment, evaluate or make any judgments about any individual performance as a player, the objective is only to get an honest opinion about the prototype to improve it.

Considering that we might use this in our master's thesis, you have this informed consent form on how your data is protected.

Thank you in advance, for taking this time to help with my master's thesis.

Activities

Activities	Purpose	Materials	Time
Introduction of the study <ul style="list-style-type: none"> • Welcome • Explanation of the study objective • Consent form 	Explain how the study will occur. There will be a consent form requesting the user's consent to take part in the study. Present the tools to participate in the study.	Google forms Webgame (Unity) Instagram Personal users phone Researchers Computer	5min
Prototype Individual Experience <ul style="list-style-type: none"> • The participant will play the "Where's the Finance: The Goldcrest Curse" prototype, and visit the @goldensonGoldcrest Instagram page, and test the mechanics. 	The participant will play the web prototype game, with the objective of finding five characters hidden in the map. During the gameplay, there will be clues to help the user, starting with only one unlocked. To unlock the others the player will be asked to scan a QR code or follow a link to an Instagram	Researcher's Computer Personal user's phone Google form pos-questionnaire:	35min

	<p>page, where the user will see a close-up of the map with an object. To continue the user has to find this object on the map. (The user will not be given instructions, having to figure out the next steps on their own.)</p>		
<p>Pos-Questionnaire</p> <ul style="list-style-type: none"> • Pos-questionnaire form • Game experience questionnaire about web game 	<p>After finishing the gameplay, the user will answer the same knowledge questionnaire. And a game experience questionnaire.</p>	<p>Google Forms Researchers Computer</p>	<p>15min</p>
<p>Final Interview</p>	<p>Interview with each participant, the players will answer some questions about the overall game.</p>	<p>Researchers Computer</p>	<p>20min</p>

D Appendix D - Co-Design Workshop Informed Consent

This document is the informed consent that was handed out to the participants for the workshop session, it is in Portuguese to accommodate the participants' native language

Informação ao Participante de Investigação e Consentimento Informado

Título do Estudo: Avaliação da Literacia Financeira em Jovens Adultos

Investigador(es) Principa(l)/is: Ana A. Santos, Master Student / Researcher eGamesLab, catarinaantunesajp@gmail.com; Lara C. Freitas, Master Student / Researcher eGamesLab, constancafreitass@gmail.com

Outros investigadores: Prof. Mara Dionísio, Prof. Paulo Bala, Prof. Pedro Campos

Objetivo do Estudo

O propósito deste estudo é compreender o nível de literacia financeira em Jovens Adultos através de uma atividade de workshop.

Procedimento

O objetivo principal da atividade de workshop é entender e explorar os conhecimentos e dificuldades dos alunos de mestrado sobre literacia financeira.

O estudo terá a duração aproximada de 60 minutos para cada grupo de participantes.

Durante o estudo, iremos requisitar que registrem os resultados das atividades na ferramenta online Miro, um espaço de colaboração virtual.

A atividade irá seguir as seguintes fases:

- Como participante recrutado, receberá um formulário de consentimento informado e deverá preencher um formulário detalhando dados demográficos e experiência anterior.
- Em seguida, irá receber informação sobre os objetivos e as ferramentas do workshop, iremos pedir que abra a ferramenta online miro onde estará disponível quadros visuais com instruções para o prosseguimento das atividades.
- No Miro, estará disponível a sua autoetnografia baseada no tema “Explorando Literacia Financeira através de Monitorização e Gestão de Finanças pessoais”, requisitada anteriormente na disciplina de Processos e Métricas de Software.
- Iremos pedir para que responda a breves questões sobre a sua autoetnografia, no miro, para que possamos entender a sua reflexão sobre a sua monitorização e gestão financeira.
- Após a sua apresentação os presentes participantes irão em seguida discutir acerca das autoetnografias de cada membro e organizar entre si uma hierarquia de temas de literacia financeira, o critério da hierarquia será escolhido pelos membros do grupo.
- Tendo em consideração a hierarquia escolhida, o grupo será dividido em 2 subgrupos, e cada um dos subgrupos irá criar uma persona onde irão incluir o tema que ficou posicionado em primeiro lugar na atividade anterior, em seguida cada grupo deverá a partir da persona criada estruturar um problema relacionado com o tema escolhido e encontrar uma solução para o mesmo. Para concluir o estudo iremos pedir a cada subgrupo para apresentar a sua persona, contendo o problema e a solução, após cada apresentação serão dados 4 minutos para que cada membro do grupo e os investigadores responsáveis pelo estudo possam fazer perguntas.

Informação ao Participante de Investigação e Consentimento Informado

Critérios de Inclusão

Será considerado elegível para participar neste estudo se: acima de 18 anos e estiver a frequentar a disciplina de Processos e Métricas de Software do mestrado de engenharia informática da universidade da Madeira.

Riscos

Este estudo não possui riscos.

Benefícios

Este estudo pode não ter muitos benefícios pessoais além da oportunidade de explorar literacia financeira através de discussões com outros alunos, mas irá ajudar a educação financeira dos jovens adultos em Portugal devido ao facto de permitir explorar e entender os temas que mais necessitam de atenção para que possam ser desenvolvidas soluções para os problemas atuais.

Compensações & Custos

Não haverá compensação nem custos para a participação neste estudo.

Confidencialidade

Durante a atividade, serão colecionados áudio, vídeo, fotos e/ou o conteúdo colocado no Miro. Estes dados serão usados estritamente para fins de pesquisa.

Ao participar no estudo, compreende e concorda que poderemos ser obrigados a divulgar o seu formulário de consentimento, dados e outras informações pessoalmente identificáveis, conforme exigido por lei, regulamento, intimação ou ordem judicial. Caso contrário, a sua confidencialidade será mantida da seguinte forma:

- Os seus dados e formulário de consentimento serão mantidos separadamente. O seu formulário de consentimento será guardado num local seguro no nosso instituto de investigação e não será divulgado a terceiros.
- Ao participar, compreende e concorda que os dados e informações recolhidos durante este estudo poderão ser utilizados pela equipa de investigação e publicados e/ou divulgados a terceiros fora da equipa de investigação. No entanto, o seu nome, informações de contacto e outros identificadores pessoais diretos não serão mencionados em qualquer publicação ou divulgação dos dados e/ou resultados da investigação.
- Para proteger a sua privacidade, ser-lhe-á atribuído um número de código, e os dados recolhidos serão registados sob este código, e não sob o seu nome. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- Quaisquer gravações de áudio serão transcritas e identificadas com o código do participante. As gravações de áudio originais serão eliminadas. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- As gravações de fotos ou vídeos serão anonimizadas, e quaisquer elementos que possam levar à identificação.

Informação ao Participante de Investigação e Consentimento Informado

- Apenas os investigadores autorizados terão acesso a estes dados. Os dados brutos só são acessíveis aos investigadores que conduzem o estudo no local físico. O restante da equipa de investigação apenas tem acesso aos dados que foram anonimizados, como mencionado acima.
- Os dados serão guardados durante dois anos após a conclusão do estudo, sendo eliminados após esse período.

Autorização Opcional

Entendo que os investigadores podem querer usar fotografias ou áudio por razões ilustrativas nas apresentações e publicações deste trabalho, para fins científicos ou educativos. Eu dou autorização para fazê-lo, desde que o meu nome e rosto não apareçam.

Assine no lugar pretendido: _____SIM _____NÃO

Direitos

A sua participação é voluntária. Você é livre de interromper a sua participação em qualquer momento. A recusa em participar ou interrupção da participação não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos. O investigador principal poderá decidir, de forma fundamentada, interromper a sua participação neste estudo. Caso se verifique esta situação, esta não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos.

Esclarecimento de Dúvidas & Contatos

Se tiver dúvidas sobre este estudo, poderá fazer agora todas as perguntas. Se quiser fazer perguntas mais tarde, desejar obter mais informações, ou desejar interromper a sua participação no estudo, entre em contato com o Investigador Principal em pessoa, por telefone ou e-mail. A informação de contato está disponível no início da primeira página deste documento.

Consentimento Informado Voluntário

Ao assinar este documento, você confirma que leu a informação acima descrita sobre este estudo, e que todas as suas perguntas foram respondidas. Assim mesmo, você poderá fazer perguntas adicionais a qualquer momento durante o estudo, e mesmo após este ter terminado. Ao assinar este documento, você concorda em participar neste estudo de investigação. Irá receber uma cópia deste documento de consentimento informado assinado e datado.

Informação ao Participante de Investigação e Consentimento Informado

ASSINATURA DO PARTICIPANTE

DATA

ASSINATURA DO REPRESENTANTE LEGAL (se aplicável)

DATA

Investigador que Obtém o Consentimento

Como membro da equipa de investigação, confirmo que expliquei ao participante acima referido a natureza e finalidade deste estudo de investigação, e que esclareci quais os potenciais benefícios e eventuais riscos da participação no estudo. Todas as perguntas foram respondidas e estou disponível para esclarecer quaisquer dúvidas que possam surgir ao longo do estudo.

ASSINATURA DO INVESTIGADOR

DATA

E Appendix E - Web Game Informed Consent

This document is the informed consent that was handed out to the participants for the web game, it is in Portuguese to accommodate the participants' native language

Informação ao Participante de Investigação e Consentimento Informado

Título do Estudo: Avaliação de protótipo sobre Literacia Financeira em Jovens Adultos

Investigador(es) Principa(l/is): Lara C. Freitas, Master Student / Researcher eGamesLab, constancafreitass@gmail.com

Outros investigadores: Prof. Mara Dionísio, Prof. Paulo Bala, Prof. Pedro Campos

Objetivo do Estudo

O propósito deste estudo é testar o jogo “Where’s the Finance: The Goldcrest Curse”, para compreender o nível de literacia financeira, o engajamento e também a usabilidade do mesmo.

Procedimento

Durante a sua participação neste estudo, será envolvido(a) numa atividade que implica a experimentação de mecânicas de jogo, específicas relacionadas à literacia financeira. Também terá que preencher dois formulários.

A duração estimada da atividade é de 1 hora e 20 minutos por participante. O investigador principal estará presente para orientar e explicar as instruções.

Durante o estudo, os resultados da atividade serão registrados pelo investigador principal.

A atividade irá seguir as seguintes fases:

- Como participante recrutado, recebe este formulário de consentimento informado para preenchimento;
- Preencherá de um formulário prévio à experiência detalhando dados demográficos e experiência anterior, assim como perguntas financeiras para acessar os conhecimentos de literacia financeira;
- Irá participar na experiência de jogo.
- Responderá a um questionário pós-jogo para avaliar o conhecimento e engajamento, sobre o conteúdo.

Critérios de Inclusão

Será considerado elegível para participar neste estudo se: tiver acima de 18 anos.

Riscos

Este estudo não possui riscos.

Benefícios

Este estudo pode não ter muitos benefícios pessoais além de contribuir para moldar estratégias futuras de educação financeira, devido ao facto de permitir explorar e entender os temas que mais necessitam de atenção para que possam ser desenvolvidas soluções para os problemas atuais.

Informação ao Participante de Investigação e Consentimento Informado

Compensações & Custos

Não haverá compensação nem custos para a participação neste estudo.

Confidencialidade

Durante a atividade, serão recolhidos dados relacionados à jogabilidade, interação e divertimento com as mecânicas de jogo apresentadas, os quais serão utilizados exclusivamente para fins de pesquisa

Ao participar no estudo, compreende e concorda que poderemos ser obrigados a divulgar o seu formulário de consentimento, dados e outras informações pessoalmente identificáveis, conforme exigido por lei, regulamento, intimação ou ordem judicial. Caso contrário, a sua confidencialidade será mantida da seguinte forma:

- Os seus dados e formulário de consentimento serão mantidos separadamente. O seu formulário de consentimento será guardado num local seguro no nosso instituto de investigação e não será divulgado a terceiros.
- Ao participar, compreende e concorda que os dados e informações recolhidos durante este estudo poderão ser utilizados pela equipa de investigação e publicados e/ou divulgados a terceiros fora da equipa de investigação. No entanto, o seu nome, informações de contacto e outros identificadores pessoais diretos não serão mencionados em qualquer publicação ou divulgação dos dados e/ou resultados da investigação.
- Para proteger a sua privacidade, ser-lhe-á atribuído um número de código, e os dados recolhidos serão registados sob este código, e não sob o seu nome. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- Quaisquer gravações de áudio serão transcritas e identificadas com o código do participante. As gravações de áudio originais serão eliminadas. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- As gravações de fotos ou vídeos serão anonimizadas, e quaisquer elementos que possam levar à identificação.
- Apenas os investigadores autorizados terão acesso a estes dados. Os dados brutos só são acessíveis aos investigadores que conduzem o estudo no local físico. O restante da equipa de investigação apenas tem acesso aos dados que foram anonimizados, como mencionado acima.
- Os dados serão guardados durante dois anos após a conclusão do estudo, sendo eliminados após esse período.

Autorização Opcional

Entendo que os investigadores podem querer usar fotografias ou áudio por razões ilustrativas nas apresentações e publicações deste trabalho, para fins científicos ou educativos. Eu dou autorização para fazê-lo, desde que o meu nome e rosto não apareçam.

Assine no lugar pretendido: _____SIM _____NÃO

Informação ao Participante de Investigação e Consentimento Informado

Direitos

A sua participação é voluntária. Você é livre de interromper a sua participação em qualquer momento. A recusa em participar ou interrupção da participação não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos. O investigador principal poderá decidir, de forma fundamentada, interromper a sua participação neste estudo. Caso se verifique esta situação, esta não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos.

Esclarecimento de Dúvidas & Contatos

Se tiver dúvidas sobre este estudo, poderá fazer agora todas as perguntas. Se quiser fazer perguntas mais tarde, desejar obter mais informações, ou desejar interromper a sua participação no estudo, entre em contato com o Investigador Principal em pessoa, por telefone ou e-mail. A informação de contato está disponível no início da primeira página deste documento.

Consentimento Informado Voluntário

Ao assinar este documento, você confirma que leu a informação acima descrita sobre este estudo, e que todas as suas perguntas foram respondidas. Assim mesmo, você poderá fazer perguntas adicionais a qualquer momento durante o estudo, e mesmo após este ter terminado. Ao assinar este documento, você concorda em participar neste estudo de investigação. Irá receber uma cópia deste documento de consentimento informado assinado e datado.

ASSINATURA DO PARTICIPANTE

DATA

ASSINATURA DO REPRESENTANTE LEGAL (se aplicável)

DATA

Informação ao Participante de Investigação e Consentimento Informado

Investigador que Obtém o Consentimento

Como membro da equipa de investigação, confirmo que expliquei ao participante acima referido a natureza e finalidade deste estudo de investigação, e que esclareci quais os potenciais benefícios e eventuais riscos da participação no estudo. Todas as perguntas foram respondidas e estou disponível para esclarecer quaisquer dúvidas que possam surgir ao longo do estudo.

ASSINATURA DO INVESTIGADOR

DATA

F Appendix F - Transmedia Experience Informed Consent

This document is the informed consent that was handed out to the participants for the transmedia experience, it is in Portuguese to accommodate the participants' native language

Informação ao Participante de Investigação e Consentimento Informado

Título do Estudo: Avaliação de Transmedia sobre Literacia Financeira em Jovens Adultos

Investigador(es) Principa(l/is): Lara C. Freitas, Master Student / Researcher eGamesLab, constancafreitass@gmail.com

Outros investigadores: Prof. Mara Dionísio, Prof. Paulo Bala, Prof. Pedro Campos

Objetivo do Estudo

O propósito deste estudo é testar a experiência Transmedia “Where’s the Finance” composta por 3 media um jogo web “Where’s the Finance: Goldcrest Curse”, um jogo de tabuleiro “Where’s the Finance: The Comeback” e finalmente uma página da rede social instagram “Where’s the Finance: @goldens.fromGoldcrest”, com o intuito de compreender o engajamento e também a usabilidade do mesmo.

Procedimento

Durante a sua participação neste estudo, será envolvido(a) numa atividade que implica a experimentação de mecânicas de jogo, específicas relacionadas à literacia financeira. Também terá que preencher um formulário, e fazer parte de uma entrevista.

A duração estimada da atividade é de 2 horas e 30 minutos por participante. O investigador principal estará presente para orientar e explicar as instruções.

Durante o estudo, os resultados da atividade serão registrados pelo investigador principal.

A atividade irá seguir as seguintes fases:

- Como participante recrutado, recebe este formulário de consentimento informado para preenchimento;
- Irá participar na experiência de jogo.
- Responderá a um questionário pós-jogos para avaliar o engajamento, sobre o conteúdo.
- Haverá uma entrevista com algumas perguntas.

Critérios de Inclusão

Será considerado elegível para participar neste estudo se: tiver acima de 18 anos.

Riscos

Este estudo não possui riscos.

Benefícios

Este estudo pode não ter muitos benefícios pessoais além de contribuir para moldar estratégias futuras de educação financeira, devido ao facto de permitir explorar e entender os temas que mais necessitam de atenção para que possam ser desenvolvidas soluções para os problemas atuais.

Informação ao Participante de Investigação e Consentimento Informado

Compensações & Custos

Não haverá compensação nem custos para a participação neste estudo.

Confidencialidade

Durante a atividade, serão recolhidos dados relacionados à jogabilidade, interação e divertimento com as mecânicas de jogo apresentadas, os quais serão utilizados exclusivamente para fins de pesquisa

Ao participar no estudo, compreende e concorda que poderemos ser obrigados a divulgar o seu formulário de consentimento, dados e outras informações pessoalmente identificáveis, conforme exigido por lei, regulamento, intimação ou ordem judicial. Caso contrário, a sua confidencialidade será mantida da seguinte forma:

- Os seus dados e formulário de consentimento serão mantidos separadamente. O seu formulário de consentimento será guardado num local seguro no nosso instituto de investigação e não será divulgado a terceiros.
- Ao participar, compreende e concorda que os dados e informações recolhidos durante este estudo poderão ser utilizados pela equipa de investigação e publicados e/ou divulgados a terceiros fora da equipa de investigação. No entanto, o seu nome, informações de contacto e outros identificadores pessoais diretos não serão mencionados em qualquer publicação ou divulgação dos dados e/ou resultados da investigação.
- Para proteger a sua privacidade, ser-lhe-á atribuído um número de código, e os dados recolhidos serão registados sob este código, e não sob o seu nome. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- Quaisquer gravações de áudio serão transcritas e identificadas com o código do participante. As gravações de áudio originais serão eliminadas. Esta tarefa será realizada pelos investigadores que conduzem o estudo no local físico.
- As gravações de fotos ou vídeos serão anonimizadas, e quaisquer elementos que possam levar à identificação.
- Apenas os investigadores autorizados terão acesso a estes dados. Os dados brutos só são acessíveis aos investigadores que conduzem o estudo no local físico. O restante da equipa de investigação apenas tem acesso aos dados que foram anonimizados, como mencionado acima.
- Os dados serão guardados durante dois anos após a conclusão do estudo, sendo eliminados após esse período.

Autorização Opcional

Entendo que os investigadores podem querer usar fotografias ou áudio por razões ilustrativas nas apresentações e publicações deste trabalho, para fins científicos ou educativos. Eu dou autorização para fazê-lo, desde que o meu nome e rosto não apareçam.

Assine no lugar pretendido: _____SIM _____NÃO

Informação ao Participante de Investigação e Consentimento Informado

Direitos

A sua participação é voluntária. Você é livre de interromper a sua participação em qualquer momento. A recusa em participar ou interrupção da participação não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos. O investigador principal poderá decidir, de forma fundamentada, interromper a sua participação neste estudo. Caso se verifique esta situação, esta não resultará em qualquer penalização, ou perda de eventuais benefícios ou direitos.

Esclarecimento de Dúvidas & Contatos

Se tiver dúvidas sobre este estudo, poderá fazer agora todas as perguntas. Se quiser fazer perguntas mais tarde, desejar obter mais informações, ou desejar interromper a sua participação no estudo, entre em contato com o Investigador Principal em pessoa, por telefone ou e-mail. A informação de contato está disponível no início da primeira página deste documento.

Consentimento Informado Voluntário

Ao assinar este documento, você confirma que leu a informação acima descrita sobre este estudo, e que todas as suas perguntas foram respondidas. Assim mesmo, você poderá fazer perguntas adicionais a qualquer momento durante o estudo, e mesmo após este ter terminado. Ao assinar este documento, você concorda em participar neste estudo de investigação. Irá receber uma cópia deste documento de consentimento informado assinado e datado.

ASSINATURA DO PARTICIPANTE

DATA

ASSINATURA DO REPRESENTANTE LEGAL (se aplicável)

DATA

Informação ao Participante de Investigação e Consentimento Informado

Investigador que Obtém o Consentimento

Como membro da equipa de investigação, confirmo que expliquei ao participante acima referido a natureza e finalidade deste estudo de investigação, e que esclareci quais os potenciais benefícios e eventuais riscos da participação no estudo. Todas as perguntas foram respondidas e estou disponível para esclarecer quaisquer dúvidas que possam surgir ao longo do estudo.

ASSINATURA DO INVESTIGADOR

DATA

G Appendix G - Engagement and Knowledge Post-Questionnaire for the Web Game

This form was used for the web game testing to evaluate the engagement and knowledge after interacting with the prototype

Where's the Finance: Engagement and Knowledge Post-Questionnaire

* Indica uma pergunta obrigatória

1. ID (if you don't remember/didn't receive, ask one of the researchers. *)

Mini PXI

2. "I liked the look and feel of the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

3. "The game was not too easy and not too hard to play" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

4. "It was easy to know how to perform actions in the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

5. "The goals of the game were clear to me" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

6. "The game gave clear feedback on my progress towards the goals" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

7. "I felt free to play the game in my own way" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

8. "I wanted to explore how the game evolved" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

9. "I was fully focused on the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

10. "I felt I was good at playing this game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

11. "Playing the game was meaningful to me" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

12. "I had a good time playing this game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Self-report

13. "I am confident in my knowledge about financial literacy" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

14. "I am knowledgeable about creating and maintaining an emergency fund" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

15. "I understand the 50/30/20 budgeting system and how to apply it to my finances" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

16. "I know how to plan for retirement" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

17. "I understand the various types of retirement plans" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Knowledge Part 1

Choose the option you believe is most correct

18. Which of the following best explains why maintaining an emergency fund is important? *

Marcar apenas uma oval.

- It enhances creditworthiness by increasing available credit limits.
- It allows for strategic investments that can yield high returns in the short term
- It helps handle sudden financial needs without relying on high-interest debt.
- It enables the acquisition of luxury goods and services by freeing up other funds

19. Which of the following is a common reason to use an emergency fund? *

Marcar apenas uma oval.

- Upgrade my car
- Taking a vacation
- Unexpected medical expenses
- Investing in the stock market

20. You lose your job unexpectedly and need to cover your expenses for the next three months. Which financial strategy is most advisable if you have a well-established emergency fund?

Marcar apenas uma oval.

- Use the emergency fund to cover your living expenses while you search for a new job
- Rely on high-interest credit cards to cover expenses and invest the emergency fund for potential gains
- Take out a personal loan to cover your expenses while keeping your emergency fund intact
- Reduce your expenses drastically and use only a portion of the emergency fund while keeping the rest for future investments

21. What is the recommended minimum amount to have in an emergency fund? *

Marcar apenas uma oval.

- 1 month of living expenses
- 20% of your income
- 3-6 months' of living expenses
- 1 year of living expenses

Knowledge Part 2

22. How do you categorize grocery shopping in a domestic budget? *

Marcar apenas uma oval.

- Essential variable expense
- Essencial fixed expense
- Non-essential variable expense
- Non-essential fixed expense

23. In the 50/30/20 budgeting system, what does the 50% represent? *

Marcar apenas uma oval.

- Savings and investments
- Discretionary spending
- Needs
- Entertainment and leisure activities

24. According to the 50/30/20 budgeting rule, how much of your income should be allocated to savings?

Marcar apenas uma oval.

- 10%
- 20%
- 30%
- 50%

25. How do you categorize going out for dinner on a domestic budget? *

Marcar apenas uma oval.

- Essential variable expense
- Essencial fixed expense
- Non-essential variable expense
- Non-essential fixed expense

Knowledge Part 3

26. What is the main difference between PPR Insurance Plans (Seguros Planos Poupança Reforma) and PPR Funds (Fundos Planos Poupança Reforma)?

Marcar apenas uma oval.

- PPR Insurance Plans have higher annual profitability rates compared to PPR Funds
- PPR Funds are safer as they guarantee the invested capital, while PPR Insurance Plans do not
- PPR Insurance Plans guarantee the invested capital, making them lower risk, whereas PPR Funds do not guarantee the capital and have higher risk but potentially higher returns
- There is no difference between PPR Insurance Plans and PPR Funds.

27. Which PPR option is most suitable for someone close to retirement and prefers low risk? *

Marcar apenas uma oval.

- PPR 1- Moderate risk due to its balanced investment strategy, the type of PPR is a fund
- PPR 2- Higher risk due to its focus on growth sectors and global trends, the type of PPR is a fund
- PPR 3- Low risk due to capital guarantee, the type of PPR is an insurance

28. Which PPR option is most suitable for someone young, far from retirement and accepts risk?

Marcar apenas uma oval.

- PPR 1- Moderate risk due to its balanced investment strategy, the type of PPR is a fund
- PPR 2- Higher risk due to its focus on growth sectors and global trends, the type of PPR is a fund
- PPR 3- Low risk due to capital guarantee, the type of PPR is an insurance

29. What is the tax deduction rate when withdrawing from a PPR after more than 8 years? *

Marcar apenas uma oval.

- 21.5%
- 17.2%
- 12.4%
- 8.6%

Financial Attitude

30. "Before buying something, I ask myself if I have paid my necessary expenses" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

31. "Before buying something, I compare prices" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

32. "Before signing a financial contract, I carefully read its contents" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

33. "I am careful to distinguish between necessary and unnecessary expenses" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

34. "Before making a major purchase, I make sure that my savings are sufficient to cover any sudden expense"

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

35. "The first thought I have when I borrow money is that I want to return the money on time" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

36. "If I know the costs I will have to incur tomorrow, I'll think about it today" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

37. "Before making online payments, I concern about the security of my data" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Este conteúdo não foi criado nem aprovado pelo Google.

Google Formulários

H Appendix H - Engagement Post-Questionnaire for the Transmedia Experience

This form was used for the transmedia experience testing to evaluate the engagement after interacting with the prototype

Where's the Finance: Engagement Post-Questionnaire

* Indica uma pergunta obrigatória

1. ID (if you don't remember/didn't receive, ask one of the researchers. *)

Mini PXI

Choose your level of agreement with the following sentences, in relation to the complete experience

2. "I liked the look and feel of the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

3. "The game was not too easy and not too hard to play" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

4. "It was easy to know how to perform actions in the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

5. "The goals of the game were clear to me" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

6. "The game gave clear feedback on my progress towards the goals" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

7. "I felt free to play the game in my own way" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

8. "I wanted to explore how the game evolved" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

9. "I was fully focused on the game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

10. "I felt I was good at playing this game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

11. "Playing the game was meaningful to me" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

12. "I had a good time playing this game" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Este conteúdo não foi criado nem aprovado pelo Google.

Google Formulários

I Appendix I - Knowledge Pre- Questionnaire for the Transmedia Experience

This form was used for the web game testing to evaluate the users' pre-existing knowledge, self-report, and financial attitude, before interacting with the prototype

Where's the Finance: Knowledge Pre-Questionnaire

* Indica uma pergunta obrigatória

1. ID (if you don't remember/didn't receive, ask one of the researchers. *)

2. What is your gender? *

Marcar apenas uma oval.

Male

Female

Outro: _____

3. How old are you? *

4. What is your profession/occupation? *

5. What is your current status of employment? *

Marcar apenas uma oval.

- Unemployed
- Part-time
- Full-time
- Outro: _____

6. What is the approximate value of your monthly salary? (after taxes) *

Marcar apenas uma oval.

- 0€-310€
- 310€-600€
- 600€-900€
- 900€-1200€
- 1200€-1800€
- 1800€-2500€
- 2500€-3000€
- 3000€ or more
- Rather not disclose

7. Have you used any of the following financial-related resources? (Select all that apply) *

Marque todas que se aplicam.

- Financial books (e.g., "Rich Dad Poor Dad," "The Intelligent Investor")
- Online financial courses (e.g., Coursera, Udemy)
- Financial seminars/workshops
- Personal financial advisors
- Financial podcasts
- Financial blogs/websites (e.g., Investopedia, NerdWallet)
- Financial apps/tools
- None of the above
- Outro: _____

Financial Attitude

choose your level of agreement with the following sentences

8. "Before buying something, I ask myself if I have paid my necessary expenses" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

9. "Before buying something, I compare prices" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

10. "Before signing a financial contract, I carefully read its contents" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

11. "I am careful to distinguish between necessary and unnecessary expenses" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

12. "Before making a major purchase, I make sure that my savings are sufficient to cover any sudden expense"

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

13. "The first thought I have when I borrow money is that I want to return the money on time" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

14. "If I know the costs I will have to incur tomorrow, I'll think about it today" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

15. "Before making online payments, I concern about the security of my data" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Self-report

16. "I am confident in my knowledge about financial literacy" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

17. "I am knowledgeable about creating and maintaining an emergency fund" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

18. "I understand the 50/30/20 budgeting system and how to apply it to my finances" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

19. "I know how to plan for retirement" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

20. "I understand the various types of retirement plans" *

Marcar apenas uma oval.

1 2 3 4 5 6 7

Corr Completely Agree

Knowledge Part 1

21. Which of the following best explains why maintaining an emergency fund is important? *

Marcar apenas uma oval.

- It enhances creditworthiness by increasing available credit limits.
- It allows for strategic investments that can yield high returns in the short term
- It helps handle sudden financial needs without relying on high-interest debt.
- It enables the acquisition of luxury goods and services by freeing up other funds

22. Which of the following is a common reason to use an emergency fund? *

Marcar apenas uma oval.

- Upgrade my car
- Taking a vacation
- Unexpected medical expenses
- Investing in the stock market

23. You lose your job unexpectedly and need to cover your expenses for the next three months. Which financial strategy is most advisable if you have a well-established emergency fund?

Marcar apenas uma oval.

- Use the emergency fund to cover your living expenses while you search for a new job
- Rely on high-interest credit cards to cover expenses and invest the emergency fund for potential gains
- Take out a personal loan to cover your expenses while keeping your emergency fund intact
- Reduce your expenses drastically and use only a portion of the emergency fund while keeping the rest for future investments

24. What is the recommended minimum amount to have in an emergency fund? *

Marcar apenas uma oval.

- 1 month of living expenses
- 20% of your income
- 3-6 months' of living expenses
- 1 year of living expenses

Knowledge Part 2

25. How do you categorize grocery shopping in a domestic budget? *

Marcar apenas uma oval.

- Essential fixed expense
- Essential variable expense
- Non-essential fixed expense
- Non-essential variable expense

26. In the 50/30/20 budgeting system, what does the 50% represent? *

Marcar apenas uma oval.

- Savings and investments
- Discretionary spending
- Needs
- Entertainment and leisure activities

27. According to the 50/30/20 budgeting rule, how much of your income should be allocated to savings?

Marcar apenas uma oval.

- 10%
- 20%
- 30%
- 50%

28. How do you categorize going out for dinner on a domestic budget? *

Marcar apenas uma oval.

- Essential fixed expense
- Essential variable expense
- Non-essential fixed expense
- Non-essential variable expense

Knowledge Part 3

29. What is the main difference between PPR Insurance Plans (Seguros Planos Poupança Reforma) and PPR Funds (Fundos Planos Poupança Reforma)?

Marcar apenas uma oval.

- PPR Insurance Plans have higher annual profitability rates compared to PPR Funds
- PPR Funds are safer as they guarantee the invested capital, while PPR Insurance Plans do not
- PPR Insurance Plans guarantee the invested capital, making them lower risk, whereas PPR Funds do not guarantee the capital and have higher risk but potentially higher returns
- There is no difference between PPR Insurance Plans and PPR Funds.

30. Which PPR option is most suitable for someone close to retirement and prefers low risk? *

Marcar apenas uma oval.

- PPR 1- Moderate risk due to its balanced investment strategy, the type of PPR is a fund
- PPR 2- Higher risk due to its focus on growth sectors and global trends, the type of PPR is a fund
- PPR 3- Low risk due to capital guarantee, the type of PPR is an insurance

31. Which PPR option is most suitable for someone young, far from retirement and accepts risk?

Marcar apenas uma oval.

- PPR 1- Moderate risk due to its balanced investment strategy, the type of PPR is a fund
- PPR 2- Higher risk due to its focus on growth sectors and global trends, the type of PPR is a fund
- PPR 3- Low risk due to capital guarantee, the type of PPR is an insurance

32. What is the tax deduction rate when withdrawing from a PPR after more than 8 years? *

Marcar apenas uma oval.

- 21.5%
- 17.2%
- 12.4%
- 8.6%

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J Appendix K - "Financial DreamScape: Puzzle Narrative Games for Financial Education"

This is an article called "Financial DreamScape: Puzzle Narrative Games for Financial Education"
by Ana Santos et. al, which we collaborated

Financial DreamScape: Puzzle Narrative Games for Financial Education

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ABSTRACT

Financial literacy is essential for personal and national economic well-being, demanding attention in today's dynamic society. However, a concerning trend persists where individuals may lack basic financial knowledge; this is common even among individuals with a high level of education. This gap is especially concerning for young adults, as it prevents them from making informed decisions, managing finances effectively, and securing a stable future. This paper presents the development and pilot evaluation of a serious puzzle game prototype to enhance financial literacy among young adults. The pilot evaluation (N=7) explores various game mechanics to deliver engaging financial education. Initial findings indicate promising potential for serious puzzle games in facilitating financial literacy. The research aims to contribute insights into pedagogical strategies and game design enhancements, fostering informed decision-making and economic stability among young adults.

CCS CONCEPTS

• **Human-centered computing** → **HCI design and evaluation methods**; • **Applied computing** → *Interactive learning environments*.

KEYWORDS

Financial Literacy; Young Adults; Serious Games; Education; Financial Behaviour

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1 INTRODUCTION

In today's dynamic society, financial literacy (FL) is a vital component of individual prosperity and national economic stability. It involves understanding financial concepts and risks and the confidence to make effective decisions in various financial situations [27]. However, De Bassa et al. [7] alert of a persisting troubling trend: many individuals lack fundamental FL despite their level of education. As highlighted by Hayei et al. [12], the financial decisions facing the younger generation, now and in the future, are expected to be more challenging than those of their parents due to the integration of new digital technology and new financial products.

As financial services grow more complex, developed nations, including those in the *Organisation for Economic Co-operation and Development*, emphasize the importance of FL [23]. In response to these emerging challenges, New Zealand launched its inaugural national strategy for FL in 2008. As outlined by Taylor et al. [23], this strategy aims to establish a high-level framework to coordinate initiatives in this field, identify existing gaps in coverage, promote flexibility through a variety of communication channels, provide appropriate financial education programs for those in need, and extend FL to as many New Zealanders as possible, sharing what works to improve the effectiveness of financial education. Similarly, Portugal launched a new plan from 2021 until 2025 that places FL education campaigns as a priority [8].

However, addressing the issue of financial education can be challenging since, for some cultures and societal norms, discussing finances is taboo, which can hinder an individual's ability to learn about financial concepts. Furthermore, since FL is many times not taught in the school context, individuals rely on trial and error to learn about financial concepts [18, 28]. One promising approach to engage younger generations in FL is through gamification and

serious games. As stated by Guigon et al. [11], serious puzzle games, such as escape rooms, have been appearing in this field, bringing many benefits such as organizational, reasoning, and implementation skills needed to tackle such concepts by challenging players or introducing alternative scenarios.

Drawing from previous research on serious games, including their impact on knowledge transfer and challenges in integrating game-based learning into formal education [2, 29], this work seeks to advance the discourse on FL and serious games. In particular, and since puzzle narrative games in educational contexts remain understudied [5], this project explores the impact and effectiveness of puzzle narrative games as an innovative educational tool to engage young adults and enhance their FL skills.

2 RELATED WORK

FL has been widely recognised as a crucial determinant of individual financial well-being. Numerous studies [4, 10, 16, 17, 20, 27] have underscored the correlation between low levels of FL and unfavourable financial outcomes. Current FL initiatives use didactic games, educational presentations, e-learning courses, and online quizzes [19, 24]. However, these approaches are still limited in terms of actively engaging in challenges, exploration, strategic thinking, critical analysis, and enhanced creativity [25]. As Rasco et al. [20] highlights, there is a limited number of FL programs targeting the youth demographic, and even fewer focus on engaging methodologies such as serious games.

Serious games, designed for educational purposes, offer unique opportunities to actively engage learners; they require players to respond to challenges and problem-solve within the game environment, promoting deep learning [2, 29]. We have encountered a series of commercial experiences that seek to leverage the potential of serious games applied to FL. For example, *Money Lessons* (recommended for ages 3+) [3], uses digital storytelling to teach about five key components of FL (earning, spending, saving, budgeting, banking); however, incorporating extensive information might overwhelm the player. *Money Masters* (recommended for ages 4+) [1] aligns financial lessons made by experts with gamification (quizzes, progress tracking, real-time investment game), favouring textual information over concept abstractions. In *Money Wise* (kids app) [9], players explore a city and roleplay as a character faced with quandaries about FL; while the game points out some intricacies in dealing with finances (e.g., online scams, terms & conditions), its rigid structure doesn't allow players to introduce their context in the gameplay. *Night of the Living Debt* (recommended for ages 4+) [15] is a zombie survival game, where players must make decisions about credit scores to survive attacks; while adopting a game approach makes play enjoyable, players might have difficulties in translating concepts into the real world context.

Cole et al. [4] emphasize the importance of FL in the growth process, emphasizing the significance of initiatives like FinCraft, an open-source gaming platform aimed at enhancing FL among the youth through gamification [20]; while this innovative approach aims to bridge the gap between financial knowledge and interest, addressing a critical aspect of youth development, no user evaluation was conducted, limiting our ability to determine which aspects

were beneficial or harmful to user engagement. While existing initiatives like FinCraft [20] and national education plans have made significant strides [8], as Rasco et al. [20, 21] highlights, the evolving nature of financial landscapes requires ongoing innovation in educational approaches. Therefore, there is a clear opportunity for research to explore novel methodologies and technologies that effectively promote FL, especially among young adults. As stated by Kim [14], “A puzzle is fun, and it has a right answer”; following this potential, our work proposes the design of an innovative puzzle game narrative that leverages puzzle mechanics to assess financial decisions made during the gameplay, impacting the direction of the narrative. By presenting users with difficulty-calibrated scenarios and requiring them to solve puzzles to progress in the immersive virtual world, we intend to cultivate essential skills crucial to FL.

3 METHODOLOGY

This section describes the development of an immersive and interactive puzzle narrative game aimed at communicating FL to young adults. The initial development phase focused on creating a low-fidelity prototype of the game, which laid the foundation for the game's narrative structure and mechanics, developed using Figma¹. We present a pilot evaluation and derive insights that feed the final proposed design of our puzzle narrative game.

3.1 Initial Game Concept

The chosen target audience is young adults, ages between 18 to 24 years old, attending higher education, since even though they might have a high level of education, these individuals may lack basic practical financial knowledge [7]. Furthermore, the prototype was developed for mobile platforms to effectively engage this demographic and broaden the amount of users.

In our game, *Financial DreamScape*, the user embarks on a journey to navigate the complexities of personal finance through a series of engaging puzzles to learn key financial principles, while experiencing the consequences of their decisions. The game, described through a first-person narrative, begins with the protagonist facing financial struggles and working on a coffee shop. As the character struggles with bills and lacking funds, they stumble upon a stroke of luck with a lottery win, only to face new challenges with irresponsible spending and frozen accounts. The core of *Financial DreamScape* lies in its mini-games, designed to educate players on essential financial concepts such as savings and budgeting. Each puzzle serves as a practical lesson, reinforcing the importance of FL in a dynamic virtual environment.

The first puzzle game starts in the player's dream. Unaware it's a dream and with no light, they navigate a corridor to find a lamp with missing pieces. These pieces represent how to budget your monthly income (the 50/30/20 budgeting rule [26]) – 50% for essential needs, 30% towards wants (like entertainment), and 20% for future savings. Each piece provides information about the rule, explaining what it is and how it works for the character.

Once the objects are inserted correctly, allowing the lamp to illuminate, the player proceeds to the kitchen, where a new puzzle game awaits. Here, the character attempts to get water but finds

¹<https://www.figma.com/>

none. The player's task is to rotate water pipes to fill buckets containing signs representing the budgeting rule: a bucket with an essential expenses symbol that the character must fill with 50% of water, a bucket with the entertainment expenses that the character should fill with 30% of water, and a bucket with the symbols of savings that the character should fill with 20% of water. While this information is also present in the previous puzzle, the game doesn't explain the budget rule in this puzzle. Upon completing this mini-game, the character wakes up. Depending on the results of the previous game, the narrative will change: if the player used the provided information to fill the buckets correctly, their account balance will stabilize; if the buckets were not filled correctly, the game will continue sending messages about unpaid bills and frozen balance. Players can repeat the puzzle to improve their FL and virtual finances.

Following this, while the character is awake, they will be led to the bank to discuss possibilities for a savings account; during this interaction, the banker will explain to the player what are compound and simple interests. Feeling overwhelmed, the character returns home to rest. Once asleep, a new puzzle game begins where the character must distinguish between compound and simple interest rates by connecting the interests with the correct rates. Once the mini-game is completed, the character wakes up, and depending on the result, the narrative will change: if the answers from the player were correct a savings account will be created, leading to a better future financial situation. The puzzle can be repeated to enhance FL and virtual finances.

Throughout these mini-games, the player observes how the decisions impact the virtual world and the character's finances, allowing them to have experiences with different approaches and outcomes. Hence, the goal of this game is to intertwine the narrative with FL-themed puzzles to give the player knowledge in areas such as savings, budgeting, and investments. The structure of puzzle games allows the game to be extended and incorporate more complex financial decisions for the player.

3.2 Preliminary Concept Evaluation

To gather feedback from the target audience about game concepts and mechanics, we conducted a user evaluation (N=7) with a low-fidelity prototype game.

3.2.1 Protocol & Measures. Participants were recruited using convenience sampling and were all college-age students (target audience). Sessions were conducted in our research institution. Each participant was provided with a consent form outlining the purpose of the study and the nature of their involvement, and their participation was contingent upon granting explicit consent. Firstly, participants completed a pre-game questionnaire to collect demographics and FL information. The demographic questions included their age, educational level, employment status, previous financial education, and financial goals. Additionally, we used a pre-game and post-game questionnaire to evaluate participants' FL perceptions, selecting FL questions based on Stella et al. [22].

Participants then interacted with the low-fidelity version of the game (figma prototype). The researcher took observation notes during the session. Due to the low fidelity nature of the prototype,

the researcher also adopted a Wizard of Oz approach [6], facilitating, completing, or explaining some of the game mechanics when needed to advance.

Following the interaction with the prototype, participants were asked to complete a post-game questionnaire with Likert items on a scale from 1 (strongly disagree) to 5 (strongly agree). This questionnaire included statements about the participant's experience with the prototype (e.g., enjoyment, challenge, frustration, etc.) and were based on the GEQ (Game Experience Questionnaire) from Ijsselsteijn et al. [13]. To conclude, participants engaged in a semi-structured interview, where they could freely express their opinions about the mechanics, game experience, and suggestions for improvement.

3.2.2 Sample. The evaluation was conducted with seven participants (5 males and 2 females) within the target audience. Participants' ages ranged from 22 to 36. All participants were enrolled in higher education (2 attending Doctoral degree programs, 4 attending bachelor's degree programs, and 1 attending a Masters's degree program). Participants reported no prior FL education.

3.3 Results

Quantitative and qualitative data are described in this section; due to the small sample size, we did not conduct a more thorough analysis process. From their pre-game questionnaire, all participants reported no prior FL education; however, their self-assessment scores of financial knowledge ranged from 2 to 4 out of 5. Most participants (N=6) emphasized the importance of saving, while most (N=6) also recognized the importance of understanding inflation. Few participants (N=2) acknowledged the importance of investments.

Compared with the post-questionnaire feedback from the FL questions. All participants stressed the importance of saving, and each one correctly answered a question about interest. Furthermore, some participants (N=4) demonstrated an improved understanding of the effects of interest rates and inflation after playing the game, suggesting a modest enhancement in comprehension compared to before playing.

In the post-questionnaire feedback about the game experience, some participants (N=4) expressed interest and enjoyment in the game's narrative, with ratings consistently ranging between 4 to 5 out of 5. Perceptions of challenge varied among respondents, with ratings extending from 3 to 5 out of 5. Regarding the time taken to achieve game objectives, most participants (N=6) rated it as moderate, scoring 3 out of 5. Opinions regarding the ease and effectiveness of the prototype mechanics for educational purposes ranged from 3 to 5 out of 5.

In the semi-structured feedback, all participants expressed that the user interface should be improved to enhance comprehension of mechanics, suggesting that animations would increase engagement. Most participants (N=6) recommended simplifying mechanics with pre-tutorials or a clearer user interface and supported incorporating everyday scenarios, rather than metaphors, into certain mechanics. When asked about their thoughts on how the financial topics were introduced in the game, all the participants mentioned that they were well introduced. However, three participants suggested that

it would be easier to understand them if the prototype attempted to explain them using methods other than text.

4 DISCUSSION AND PROPOSED RE-DESIGN OF FINANCIAL DREAMSCAPE

Results from the pilot evaluation indicate the potential for the *Financial DreamScope* game to introduce FL concepts in an engaging way since participants expressed interest and enjoyment in the game’s narrative. However, the game still has room for improvement in the effectiveness of the game mechanics in delivering FL content (educational purpose), as seen from the medium score ratings. Another challenging issue pointed out by the participants is the user interface, the lack of freedom to move the character around the game, and the lack of pre-tutorials for the puzzle mini-games which would simplify the mechanics. Drawing from these insights gathered during the testing process, an iterative development was initiated to enhance the game’s design and educational content, and a re-design is proposed in Figure 1.

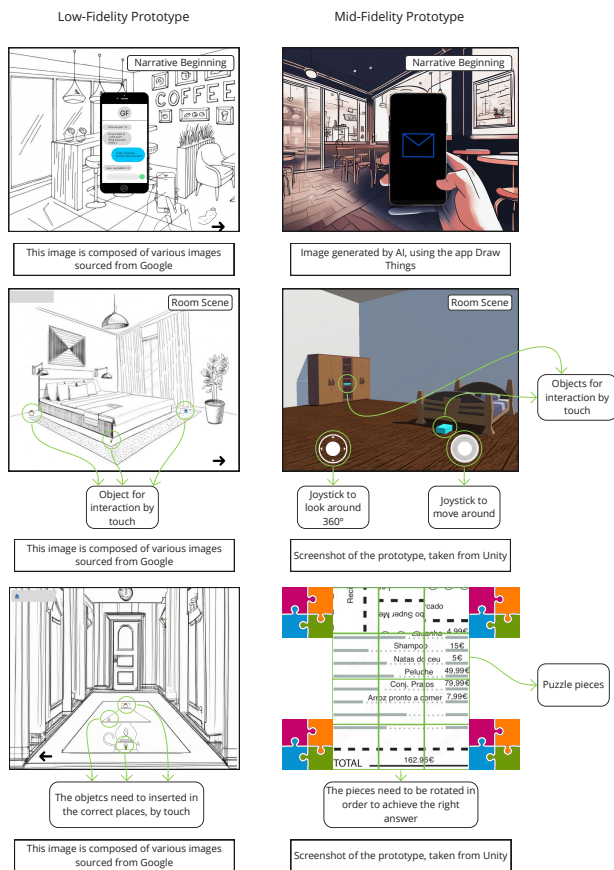


Figure 1: Comparison Low-Fidelity Prototype to Mid-Fidelity Prototype

This mid-fidelity prototype, which we are developing using the Unity game engine, departs from metaphorical approaches and employs realistic scenarios within the virtual reality environment to

effectively teach FL concepts. The puzzles were modified in alignment with user testing feedback to ensure a smoother and more engaging gameplay experience; this allows players to move around the game and explore scenarios more freely, enhancing player interaction with the scenarios. Additionally, touch interactions and animations were added to the puzzles, enabling users to visualize what is happening and improving their overall experience. Furthermore, the narrative was enriched by incorporating messages from bills and illustrating financial consequences, such as the bank balance, to enhance the player’s immersion in the immersive educational journey.

In addition to study limitations (e.g., small sample, low fidelity of the prototype), we also acknowledge limitations to how story events emerge. For example, one notable limitation of our prototype is the inclusion of certain game events, such as the lottery, which may not lead players to take good financial precautions. In the mid-fidelity prototype, this game event has been removed to focus on more realistic scenarios like interacting with your phone and banking apps.

5 CONCLUSION AND FUTURE WORK

This work focuses on developing an educational game using Unity, aimed at teaching FL concepts. The game mechanics engage players in decision-making through interactive puzzles integrated with metaphors to enhance learning. Preliminary evaluations through user testing have provided valuable feedback for refining the game’s mechanics, user interface clarity, and narrative coherence. Moving forward, we aim to conduct another evaluation with the mid-fidelity prototype to identify areas for improvement.

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K Appendix L - "Where's the Finance?: A Transmedia Storytelling Experience to Engage Young Adults in Financial Educational Content"

This is an article called "Where's the Finance?: A Transmedia Storytelling Experience to Engage Young Adults in Financial Educational Content" that we published

Where's the Finance?: A Transmedia Storytelling Experience to Engage Young Adults in Financial Educational Content

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Abstract. Financial literacy is an essential life skill that deeply impacts individuals' personal and economic well-being; it includes understanding concepts essential for navigating the complexities of finance like budgeting, savings, investment, and debt. However, traditional financial education methods often struggle to engage learners effectively. This work discusses how entertainment education approaches, in particular, Transmedia Storytelling (TS), can be used to deliver financial literacy content. In this work, we want to examine the use of two common media in the TS field (web game and board game), to understand its barriers and benefits: a) "Financial Frenzy" emphasizes a team experience composed of a board game that leverages the collaborative nature of gameplay to foster learning and teamwork among the participants; b) "Where's the Finance?" relies on an individual educational experience composed of a puzzle game encouraging exploration and discovery. We conducted a pilot study of the two media, and results showed different potentials for the two concepts; therefore, we unified both concepts and present a redesign of the TS experience to continue studying the potential of transmedia to deliver financial educational content.

Keywords: Financial Literacy · Young Adults · Entertainment Education · Transmedia Storytelling · Board Game

1 Introduction

Financial literacy (FL) is a multidimensional concept crucial to individuals' financial well-being and decision-making with diverse definitions and perspectives emerging in academic discourse. For instance, for some authors [12], FL is defined as being able to use knowledge and skills to manage finances effectively for financial security, while for others it is the relationship between financial knowledge, financial attitudes, and financial behaviors [14]. In the scope of this work, we consider the *Organization for Economic Cooperation and Development (OECD)* definition for FL as “*possessing the knowledge, skills, motivation, and*

confidence to apply financial concepts and risks for decision-making across diverse economic contexts: it is a tool to enhance not only one's fiscal well-being but also society's overall economic participation—an essential resource” [25]. Several studies [20,21,22] characterize FL as an indispensable tool to traverse today's economic terrain. Individuals with enhanced FL demonstrated a propensity for advantageous monetary actions (e.g., they effectively plan for retirement, clear credit card debts, and make informed investment decisions).

However, FL is a complex topic, and many people lack a basic understanding of financial definitions. Moreover, young adults face additional obstacles, as they often lack interest and access to financial education; formal education systems may not adequately cover financial topics, leaving them unprepared for real-world financial decisions [23]. The current educational approaches on this complex topic are traditional mediums such as classroom learning, books, slides, and websites [2,6,15].

We propose that TS presents a promising alternative to conventional teaching methods for FL education. The immersive and engaging nature of TS can potentially facilitate a more comprehensive understanding of FL concepts among young adults, by delivering an interconnected story that approaches FL content, leveraging expanded audience engagement, the power of immersive storytelling/world-building and interactivity [8,10]. Motivated by this potential, we seek to design a full transmedia experience; in this paper, we report on the design and early evaluation of two possible concepts of the experience, to understand their potential and caveats in delivering financial education.

Intending to address the challenges outlined and the opportunities offered by new media channels, we propose two concepts: "Financial Frenzy" and "Where's the Finance?". For clarity, we refer to them in the article, as Concept A and B, respectively. Concept A involves a collaborative approach to learning – participants engage with a board game that simulates real-life financial scenarios, a flashcards app that reinforces the key concepts, and a social media page that facilitates ongoing discussion and discovery. Concept B is an individualistic experience – participants engage with a puzzle game where they must uncover characters representing different financial principles hidden in the map, a coloring book to reduce anxiety, and a social media page that fosters discussion.

To evaluate the effectiveness of these approaches, and understand which media had more potential, we conducted a pilot study. The key findings from the pilot study were that some participants demonstrated an increase in the knowledge score after engaging with the transmedia experiences and both the team-based and individualistic approaches were effective in engaging participants and fostering learning, suggesting the potential of this approach in delivering FL content. We also present a redesign and refinement of the final concept.

2 Literature Review

In this section, we start by outlining the potential of using Edutainment and, in particular, a TS approach to deliver educational content. And then, we lay out

the current initiatives that leverage the advantages of immersive and interactive media specially designed for FL education.

2.1 Transmedia Storytelling

Henry Jenkins is considered the father of the term “Transmedia Storytelling”, which is a process where integral elements of fiction get dispersed systematically across multiple media to create a unified and coordinated entertainment experience. Ideally, each medium makes its unique contribution to the unfolding of the story, and this approach allows creators to expand their stories beyond the confines of a single medium and engage with audiences in new ways [3]. Moreover, this format actively engages users, encouraging them to interact with and even influence the story, playing a crucial role in the narrative’s expansion and depth [11].

2.2 Edutainment and Transmedia Storytelling for Education

Edutainment, a blend word of "education" and "entertainment", represents a dynamic approach to learning that leverages the engaging elements of entertainment media to deliver educational content [7]. This innovative form of instructional design seeks to bridge the gap between traditional education and learners’ evolving needs and preferences in the digital age.

Edutainment can manifest in various forms, such as video games, interactive simulations, virtual reality experiences, and multimedia content, aiming to make learning more enjoyable, accessible, and effective [26]. Numerous studies have explored the efficacy of edutainment across various educational domains. For example, Lien used edutainment in a museum using smartphone games to engage visitors in interacting with artifacts [19]. In today’s educational setting, traditional methods are evolving, and educators seek innovative techniques to engage students, foster creativity, and enhance learning outcomes [6,15]. In this way, TS may be a response to this search within the educational context offering exciting possibilities to create compelling stories that deliver effective educational messages. In another instance, Bidarra et al. [28] present a prototype for learning English, as a second language, through TS; the study found that the prototype was effective in promoting language learning and that students enjoyed the experience, concluding that TS offers an opportunity for beneficial educational purposes.

Despite these encouraging examples showcasing how TS can be a powerful tool, we can not ignore that it might pose its challenges as well as Kwon et al. [18] highlight in their work the limitations of TS in the entertainment and education sectors. They identify several limitations of TS, including difficulties in collaboration between different media platforms and failure to consider consumers who might not be interested in more than one media platform.

2.3 Interactive Media for FL Education

FL plays a crucial role in empowering individuals to make informed financial decisions and researchers have explored various strategies to enhance FL, from innovative technologies to engaging games. For example, Klontz et al. [16] explored the impact of an interactive multimedia program that used an animated teen story, text and graphic overlays, interactive exercises, and supplemental printouts to deliver instructions on financial competence among at-risk youth. The study aimed to enhance FL through psychoeducational interventions; their results indicated that this approach had positive effects, contributing to improved financial understanding and competence.

Another research initiative by Kuchciak et al. [17] showed the importance of leveraging social media as an attractive and modern channel for promoting FL. Their study focused on the role of social media in improving financial education among bank customers, their findings. Another example is "Next Gen Personal Finance" which has several web games about many financial topics [1].

3 Exploring Social and Individualistic Concepts for TS Experiences

Since FL is such a complex and multilayered topic [23], we propose that it is better suited to be disseminated across multiple platforms using TS. Additionally, while transmedia experiences and games are abundant, the integration of FL within these experiences remains underexplored. In this section, we describe two initial concepts to analyze their potential, given the limited evidence on which media best suits the approach to FL concepts. The two concepts may have similarities, yet they are two distinct experiences that do not interrelate with each other.

Before explaining the rationale behind each of the design concepts, it is important to highlight the rationale behind the choice of educational content. For the choice of the FL themes, we took into consideration a study by Solheim et al. [29], which explores college students' narratives about financial socialization experiences within their families; key findings showed that "*the three most prevalent themes about what and how students learned about finances are reported: saving, money management practices, and family communication patterns*". Another study by Webley et al. [31] examined the economic socialization of young adults in Europe, highlighting how savings and budgeting are essential for young adults' financial health. Additionally, a study by Totenhagen et al. [30] states that the US Department of the Treasury argues that a successful program should focus on basic savings, credit management, home ownership, and retirement planning. Finally, empirical evidence supports the importance of budgeting and saving across all developmental periods, from preschool-aged youth [27] to college-aged young adults [24]. Taking this literature into consideration, we decided to focus mostly on savings and expenses/debt, since these are the most important and basic concepts that young adults should know about.

3.1 Concept A – "Financial Frenzy"

This experience is distributed through three main channels :

1. "Financial Frenzy" (see fig. 1) – a board game designed to teach FL concepts such as debt and savings;
2. "FitFrenzy" – a mobile application designed to train financial concepts, and supposed to be played after the board game;
3. "@goldensfromGoldcrest" – a social media profile that engages users by fostering discussion and communication about relevant topics.

Given our desire to explore social and individualistic concepts in TS, we describe (and evaluate) only *Financial Frenzy* as it involves competitive and collaborative social elements to promote conversation about financial struggles and experiences. Players are divided into two teams and aim to reach the end of the board by completing challenges determined by two dice, one for movement and one for the type of challenge. The challenges include:

- *Question Cards*: Multiple-choice questions to test financial knowledge.
- *Drawing Challenges*: Players draw financial concepts for teammates to guess, promoting understanding of abstract ideas.
- *Forbidden Words Challenges*: Players describe financial terms without using specific words, encouraging creative thinking and discussion.
- *Memory Game (Optional Challenge)*: Can be played when trying to answer the question card offering additional educational content. The content of the cards are definitions related to the topics on the question cards (red for debt, yellow for savings); this was designed to be an alternative method for those who wished to know more about FL topics.

3.2 Concept B – "Where's the Finance?"

The transmedia channels for this experience are:

1. "Where's the Finance?" (see fig. 2) – a web game where the player explores financial narratives;
2. "Relaxing with the Goldens" – a coloring book linked to the web game;
3. "@goldensfromGoldcrest" – a social media page, similar to the one previously mentioned.

For concept B, we wanted to explore delivering FL content as individual experiences, focused on introspection and reflection. *Where's the Finance?* is a web-based game where players assume the role of financial detectives tasked with identifying and addressing financial challenges faced by characters. Players progress by finding characters in a map; to help the players, detailed descriptions of characters and their financial challenges are presented in envelopes and cards, covering issues such as budgeting dilemmas and investment decisions. After finding the character, the users play a mini-game with a lesson addressing the financial problem, related to the financial challenge of the character, providing players with a hands-on application of financial knowledge.

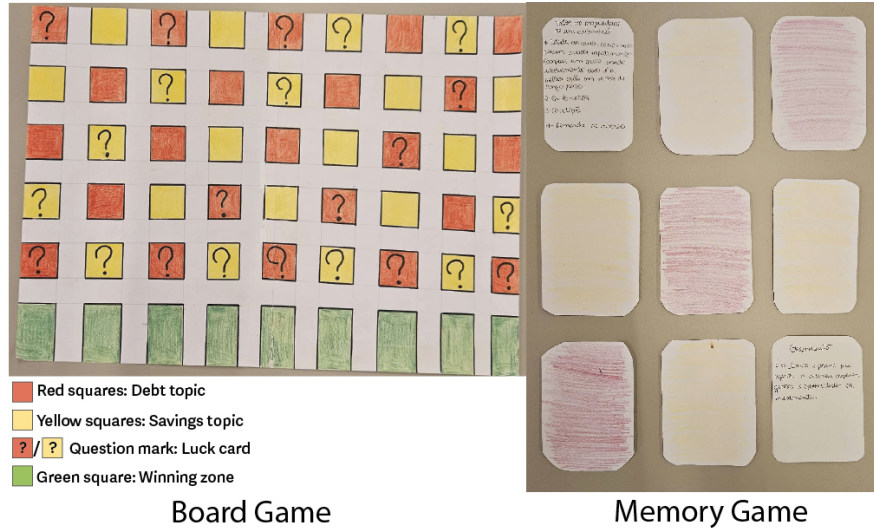


Fig. 1. Low-fidelity prototype for "Financial Frenzy". On the left is the boardgame, and on the right is the memory game.

4 Pilot Evaluation

We sought initial feedback on the two game concepts to assess their effectiveness in teaching FL and players' perception. For this pilot evaluation, we chose low-fidelity prototypes of elements of each TS experience (the physical gameboard of concept A and a digital prototype (in Figma) of the web game in concept B) and conducted a counterbalanced within-subject evaluation.

4.1 Protocol

Participants ($n=8$) were recruited through convenience sampling (using an University Discord server) to participate in a playtest that took place in our research center. Participant's ages ranged between 18 to 30 years old; 62.5% were female, all students, and all familiar with games. The session started with the researcher explaining the protocol and collecting consent. Prior to the session, participants filled out a questionnaire with demographic data and FL multiple choice questions and were explained the rules for each game. Based on financial definitions from a financial website [2] and the content in the games, seven FL multiple choice questions were used (e.g. "What is an emergency fund?", "How long should the emergency fund cover?", "What are the three types of expenses in a budget?", etc.).

Order of game A and B was counterbalanced. For game B, participants played individually; for game A, P1-P4 and P5-P8 played as groups. After the first game, participants repeated the questionnaire with FL questions.

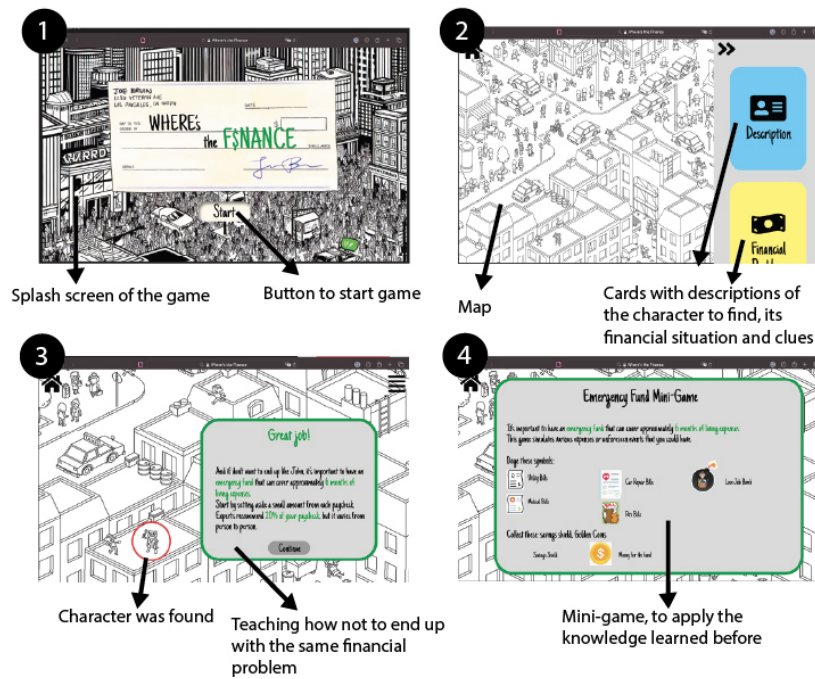


Fig. 2. Where's the Finance is a single-player game where players explore a map to find characters while learning about their financial problems: 1) game's start screen; 2) the map and cards with character's description (blue) and financial problem (yellow); 3) when the character is found, a popup informs the player about the financial problem, 4) the mini-game to apply learnt knowledge.

After each game, participants filled out a questionnaire with the Game Experience Questionnaire (GEQ) [13] and responded to some open-ended questions by the researcher; audio was recorded and later transcribed. The GEQ comprises 4 modules, measuring various components (from 0 to 4) like *Flow*, *Competence*, etc. For both games, we used the In-Game and the Post-game module; for game A, since we have a social aspect, we additionally used the Social Presence module. Quantitative results were analyzed using R. Due to the small number of participants and the pilot nature of the evaluation, we did not seek statistical methods.

4.2 Results

After analyzing the data collected, we summarized results from the GEQ [13] into table 1 (means and standard deviations) and fig. 3 (boxplot distributions).

The results from Concept B show promising outcomes. Most participants rated high in *Competence* and *Positive Affect* (with a mean of 3 and 3.38, respectively). In the *Challenge* dimension, only two participants gave high scores (above 3), indicating a need for increased difficulty in a future redesign. Low scores in *Negative Affect* and *Negative Experience* were consistent with high *Positive Affect* and *Positive Experience* ratings.

For Concept A, participants also reported high scores in Competence (mean of 3.06). In the *Challenge* dimension, scores indicate a perceived challenge. Low values in *Negative Affect* and *Negative Experience* aligned with high *Positive Affect* and *Positive Experience* ratings. Additionally, Social Presence (see fig. 4) dimensions was also adequately distributed.

Overall, Concept A and Concept B scored similar values in terms of game experience. Due to repetition of content in Concepts A and B, FL questions were only evaluated for the first game played. The accuracy of users' responses improved after participating in the experiences, as shown in Figure 5.

We grouped the participant's reflections and ideas, collected during gameplay and the open-ended questions into categories for each game. For Concept A, the board game, we grouped the quotes into the following four categories:

- **Memory Cards:** We understood that the players who were not familiar with a certain FL concept needed further aid (P2 "*It would be good to have an explanation on the cards, for example, a financial consultant is very specific*"), so they suggested adding in all cards a small explanation of the concepts. Participants emphasized the importance of clarity in memory cards by suggesting color removal (P1 "*Remove the colors from the memory cards, because it helps to know which one it is*") and adding explanatory details.
- **Media Expansion:** Participants wanted to expand the story world in other media; some suggested the creation of an app to complement the game (P4: "*There could be an app, and it would give prizes throughout the game*").
- **Engagement:** Participants showed positive engagement and discussion of these complex topics with the peers they were playing with (P4 "*It is more*

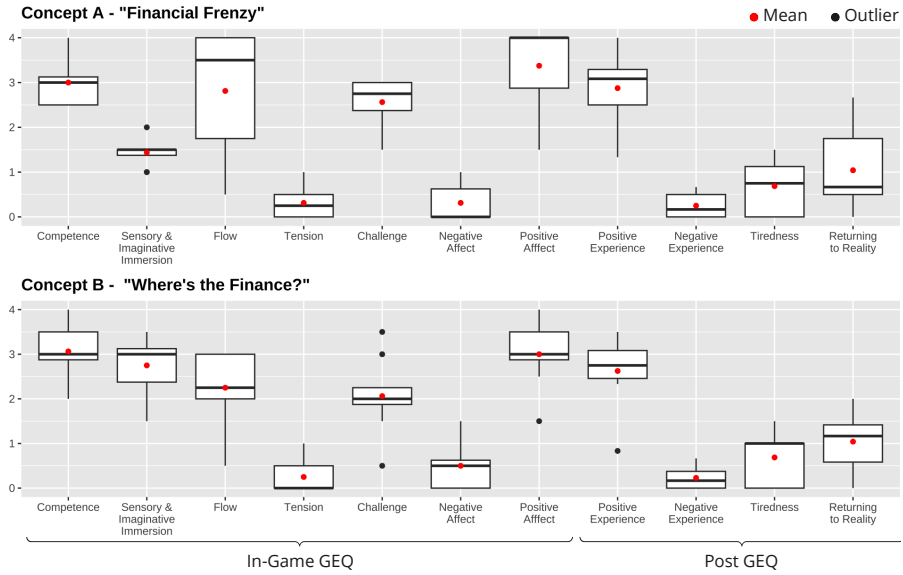


Fig. 3. Boxplot distributions for In-game and Post-game GEQ components for Concept A (n=8) and B (n=8)

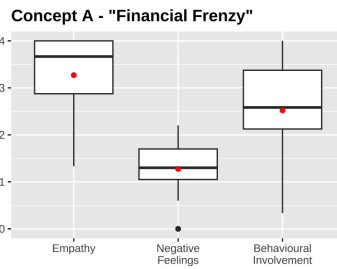


Fig. 4. Boxplot distributions for Social Presence GEQ component for Concept A (n=8)

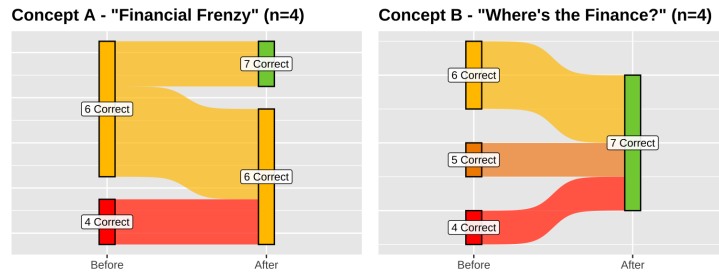


Fig. 5. Alluvial diagram showing correct answers in FL questionnaire, before and after Concept A (n=4) and B (n=4).

Module	Component	Concept A	Concept B
In-Game	<i>Competence</i>	3.00 ± 0.53	3.06 ± 0.62
	<i>Sensory & Imaginative Immersion</i>	1.44 ± 0.32	2.75 ± 0.71
	<i>Flow</i>	2.81 ± 1.44	2.25 ± 0.85
	<i>Tension</i>	0.31 ± 0.37	0.25 ± 0.38
	<i>Challenge</i>	2.56 ± 0.56	2.06 ± 0.90
	<i>Negative Affect</i>	0.31 ± 0.46	0.50 ± 0.53
	<i>Positive Affect</i>	3.38 ± 0.95	3.00 ± 0.76
Social Presence	<i>Empathy</i>	3.27 ± 0.97	–
	<i>Negative Feeling</i>	1.27 ± 0.72	–
	<i>Behavioural Involvement</i>	2.52 ± 1.30	–
Post-game	<i>Positive Experience</i>	2.88 ± 0.87	2.62 ± 0.83
	<i>Negative Experience</i>	0.25 ± 0.28	0.23 ± 0.25
	<i>Tiredness</i>	0.69 ± 0.65	0.69 ± 0.59
	<i>Returning to Reality</i>	1.04 ± 0.97	1.04 ± 0.68

Table 1. Mean and standard deviations for GEQ components for Concept A (n=8) and Concept B (n=8)

fun to play in teams and I liked the mini-games"); they emphasized the importance of dynamic features (P3 "*I liked the forbidden words cards, it made the game more dynamic*") to keep players engaged and not an overwhelming amount of information.

- **Game suggestions:** With the participants' feedback, we understood that for players that tested Concept B first, they wanted to apply the knowledge gained from the previous phase and test their knowledge to see if they were able to retain the information, and they also had some suggestions for improvements and new games (P3: "*Hangman game, could be another game*").

Likewise, for Concept B, the web game, we grouped the quotes into the following four categories:

- **Money incentives:** Participants felt the need to apply the money more directly and learn how to manage it (P1 "*There could be money, to apply what they learned*", P4 "*There could be money like monopoly*"). Participants suggested incorporating financial incentives and diversifying gameplay with activities or apps.
- **Links:** Participants wanted to personalize the content and discover more about the financial topics. They suggested the presentation of links to explore the topics further (P6 "*Have a section where you have everything you learned with links, that you could go back to*").
- **Engagement:** Participants showed positive engagement (P6 "*I think the web game is more fun*") and some reflection on their own financial doubts (P8 "*The mini-games seemed like an achievement, like now that you know this apply the information you learned*"); they emphasized the importance of dynamic features to keep players engaged, and not a lot of information at

the same time making the user less confused (P8 "*I found it cool that there was not a lot of information, it is interesting.*").

- **Game suggestions:** With the participants' feedback, we understood that they wanted to apply what they learned on the journey of the characters and make sure they learned the financial concepts, and also had some suggestions for improvements, like creating a happiness meter for the town (P6 "*There could be a happiness meter for the town*") or even see how the passage of time would affect the economy (P3 "*There could be a part of the game where the time would pass and the players would see the results of that time on their financial assets*"). We could see interest in long-term gameplay (P6 "*I would have liked to see what happens in the long run when making a financial decision*") and investment in new game mechanics (P4 "*The screen could be split, one side we could do things, and the other side could be the results*").

5 Discussion

Through our pilot study, we were able to evaluate the potential effectiveness of using different game approaches, specifically web-based and board games, in enhancing FL. Similarly to what Webley et al. [31] reported, in our pilot study, users also showed some difficulties on essential topics for young adults' financial health, such as savings and budgeting, more specifically, debts. It was evident that even when participants had some understanding of the broader topics we were trying to teach, they lacked the fundamental skills needed to execute these concepts effectively. Seeing some of the participants struggling with basic concepts of FL but at the same time engaged with both games gave us even more assurance to continue the pursuit of improving our TS experience. In particular, it was interesting to see that while we did not test the whole transmedia, it was the participants who hinted the need for more types of media that would expand the experience. Participants suggested having a complementary mobile application to the board game and in the web game to be able to follow up with further information regarding some of the topics presented. Additionally, the participants showed the need for long-term gameplay to understand how the economy and their financial decisions would affect the story world (and how this would translate into an impact on their lives).

5.1 Re-design of TS Experience "Where's the Finance?"

Considering the observed findings, we present a re-design proposal for our TS experience that represents a union of knowledge and experimentation. Our pilot study showed that both games had potential in different aspects. For example, we saw that, similarly to what Boghian et al. [9] reported, the board game had a strong social and engaging component with the potential to address educational topics such as FL. This opens up the possibility for participants to discuss FL in a light and relaxed way and, in this way, counteracting the tendency of FL being a taboo topic [4,5]. On the other hand, we saw that the web game since it's a

more individualized experience, allows participants to delve into the FL concepts in more depth and have the potential for more FL knowledge acquisition.

Therefore, since both games presented potential that we considered essential for impacting FL, we decided to incorporate both web game and board game into a single TS experience. Below, we present how the redesign incorporates concepts A and B; yet, we opted to keep the title and overall narrative as the one from "Where's the Finance?" as this story world had more transmedia potential due to its characters and their stories. The experience integrates the board, web game, and Instagram page, where all elements work together within a single story arc, maintaining continuity through shared characters and themes, creating a seamless and immersive transmedia experience. Figure 6 illustrates the different media channels for the final TS experience.

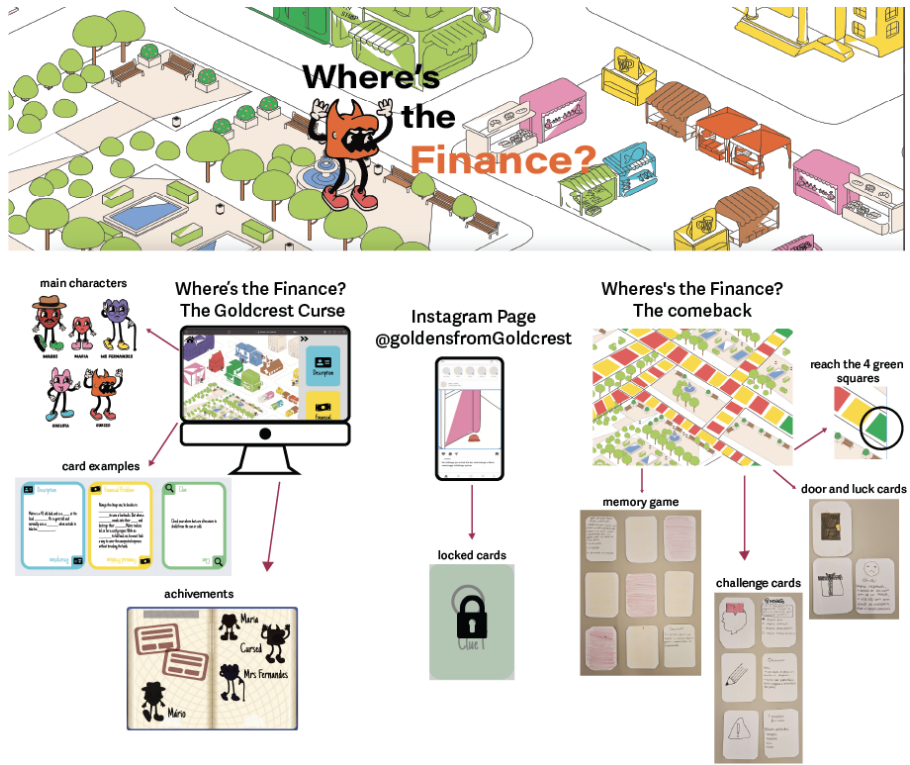


Fig. 6. Different media channels for the final TS experience, composed of: 1) "Where's the Finance? The Goldcrest Curse" – a narrative web game , 2) "@goldensfromGoldcrest" – a social media page, and 3) "Wheres's the Finance? The comeback" – a group board game.

Overall Transmedia Narrative The game takes place in the mystical world of Goldcrest, home to the Goldenes where they face a curse; the player is tasked by the Mayor to unravel the curse. The goal is to help five townsfolk (each with their own financial situation) and lift this curse. Players will see the consequences of the characters' actions and learn from them. The transmedia experience is divided into three media; the preferred order would be to play the web game to learn about the characters, then enter instagram since the web game will not progress without the information from it, and finally, the board game is a sequel where the players help the characters one last time and learn new financial topics.

"Where's the Finance? The Goldcrest Curse" This narrative web game is an individual experience, where players assume the role of financial detectives tasked with identifying and addressing financial challenges faced by virtual characters, they navigate through a map representing hundreds of characters. In Figure 6, we can see the five main characters with their cards – the blue card shows their character description, the yellow card their financial situation, and the green cards are clues.

"Where's the Finance? The comeback" From the direct feedback of the participants, we re-designed the visual of the board game so that there is no confusion regarding the question marks on the board. We used shamrocks to symbolize luck, and added more detailed explanations on the board game cards. Players are organized into two teams; the players transverse the board collecting tokens with different powers, and need to reach the four green squares (collecting stamps) to win. Two dice are used, to move through the board and to choose challenges (question cards, drawing challenges, and finally forbidden words challenges).

5.2 Limitations and Future Work

We acknowledge that our research approach encountered several limitations. We could not test the whole extent of the TS experiences since developing all the channels would require a longer time frame and resource investment. Our pilot study was also conducted with a small participant sample. Moreover, another limitation arose from the differences in gameplay mechanics and duration between the web-based and board games, with the board game being more complex and time-consuming. Therefore, our future work will continue by developing the "Where's the Finance" transmedia experience to deliver FL educational content and conduct extensive playtests of the experience. We plan that these evaluations will study the effect of the different media channels on the overall FL literacy acquisition.

6 Conclusion

With this research, we propose to enhance FL with the aid of a TS experience. To do this, we created two low-fidelity prototypes to test the efficiency of these media, as well as the use of TS in the FL education field. Our prototypes showed complementary ways of engaging with the topic of FL. Our work contributes to the body of work that presents novel approaches to engage young adults in the field of FL education; hence, we hope to continue to develop enhanced learning experiences, eventually contributing to a better educational landscape.

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L Appendix M - Transmedia Semi-Structured Interview Questions

This document shows our questions for the semi-structured interview for the transmedia experience test

Transmedia Semi-structured Interview

Experience with the media

- What was your initial reaction to the board game? How easy or difficult was it to collaborate with others?
- Can you describe your experience with the web game? Did it feel different from the board game? In what ways?
- How did you interact with the Instagram component? Was it easy to use? Did it enhance your experience of the web game?
- How did you feel about using multiple platforms (board game, web game, Instagram) to engage with the story? Did it make the experience more engaging or challenging for you?

Learning and engagement

- Do you feel that playing the board game improved your understanding of financial literacy? Can you give an example of something you learned?
- How did the web game contribute to your understanding of financial concepts? Did it reinforce or contradict what you learned from the board game?
- What aspects kept you engaged, and what aspects, if any, diminished your engagement?

Storytelling

- Can you describe how the story impacted your engagement with the financial literacy content? Did it make the learning experience more immersive?
- Was there a particular part of the story or any element of the transmedia experience that stood out to you? Why?

Suggestions

- If you could change one thing about the board game, what would it be and why?
- How could the web game be improved to enhance your learning or engagement?
- Was there anything about the Instagram component that was confusing or could be improved?

Ending

- Is there anything else you'd like to share about your experience that we haven't covered?

M Appendix N - Web Game Semi-Structured Interview Questions

This document shows our questions for the semi-structured interview for the web game test

Where's the Finance: Goldcrest Curse - Interview:

1. Did you learn any new financial strategies or concepts from the game?
2. What are your biggest frustrations or challenges related to financial literacy, mentioned during the game?
3. After playing the game, did you feel that there was any habit that you would change, related to financial topics?
4. How has this experience contributed to feeling more informed/aware of the financial topic?
5. Did you identify with any particular character in the game? If so, which one and why?
 - a. Did identifying with a character help you understand certain financial concepts better?
6. Do you intend to take any steps to improve your retirement planning after interacting with this character (Carlota)?