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A Resource-Management Strategy Game for Teaching Financial Principles to STEM Professionals

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Abstract.

This work presents the development of a serious strategy game designed to teach fundamental financial management principles to professionals and students in engineering, computer science, and related STEM fields. The game simulates real-life financial challenges and decision-making scenarios through a mechanics-driven experience adapted to the financial context. Players must manage limited resources, balance budgets, prioritize spending, and build emergency funds while facing unforeseen events such as economic crises or unexpected expenses. The educational objectives include fostering understanding of personal and business financial planning, promoting awareness of financial risks, and highlighting the importance of building financial resilience. The gameplay incorporates immediate feedback to reinforce the consequences of decisions — for example, overspending may lead to high-interest loans. The learning curve progresses gradually, starting from basic concepts like budgeting and evolving toward more advanced topics such as investment strategies and long-term planning. To support engagement and retention, the game features a narrative structure based on relatable challenges and offers competitive elements through ranking systems based on financial health rather than accumulated wealth. Developed using a low-code platform, the prototype is designed for easy adaptation and scalability. The game is designed to increase motivation and improve conceptual understanding suggest increased motivation and improved conceptual understanding, reinforcing the potential of serious games as accessible tools for professional financial education in STEM domains.

Keywords: Serious Games; Financial Education; Strategy Game Design; STEM Education; Game-Based Learning.

1 Introduction

Nowadays, professionals in Science, Technology, Engineering, and Mathematics (STEM) fields, frequently assume financial planning responsibilities without specific training in accounting or resource management. The lack of this knowledge limits efficiency in organizing projects and events, directly impacting decision-making and the appropriate use of available funds.

According to Laamarti et al. [1], serious games are established as powerful alternatives for teaching practical skills, as they combine simulation, interactivity, and decision-making in controlled environments, bringing theory and practice closer together. Similarly, Ullah et al. [2] highlight that the application of serious games in education increases engagement and promotes active learning, especially in areas that require the assimilation of complex concepts, such as finance and management.

In accounting education, practical experiences with business games have demonstrated a positive impact on the development of fundamental competencies. Ferreira Filho [3] shows that the flow experience provided by board games can motivate students and make learning more meaningful. Complementing this approach, Garcia et al. [4] validated the use of games in cost accounting education, indicating greater content retention when compared to traditional methods.

Furthermore, recent studies emphasize the importance of gamification and the use of game elements as a strategy in higher education in Accounting and Business Administration [5]. These resources, when well-planned, place the student at the central agent of the process, reinforcing experiential learning, as defended by Kolb [6].

Given this scenario, this work presents a proposal for developing a resource management simulation game aimed at STEM professionals, with the objective of teaching basic financial principles applied to the reality of academic projects. The aim is thus to offer a practical, interactive, and adaptable learning tool that contributes to reducing this lack of financial training among these professionals.

The structure of the article is organized as follows. Section 2 presents the literature review on serious games, gamification, and financial education. Section 3 describes the materials and methods used in game development. Section 4 discusses expected results. Section 5 analyzes the findings in light of the literature. Finally, section 6 presents the conclusions and contributions of the study.

2 Related Work

2.1 Serious Games

Serious games are defined as games whose purpose goes beyond entertainment, seeking to achieve instructional, social, or awareness objectives [1]. This type of game has gained prominence in educational contexts due to its ability to integrate theoretical knowledge with practical situations, promoting learning through the simulation of realistic experiences. The main characteristic of serious games is pedagogical intentionality, which differentiates them from traditional games.

According to Laamarti et al. [1], the structure of a serious game involves components such as engaging narrative, clear rules, defined objectives, and constant feedback. This structure is illustrated by Fig. 1. These elements create an interactive environment where participants can explore decisions, test hypotheses, and reflect on the consequences of their actions. This process favors the development of cognitive and behavioral skills essential for professional contexts.

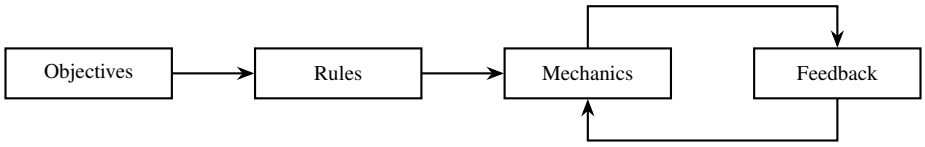


Figure 1. Structural components of an educational serious game. Adapted from Laamarti et al.[1].

Furthermore, serious games offer an active learning space where error is allowed and is part of the knowledge construction process. This approach stimulates learner autonomy, problem-solving, and adaptation to unforeseen situations, aspects especially relevant in the training of professionals in areas such as engineering, technology, and applied sciences.

Thus, the use of serious games in education has been consolidated as an innovative and efficient pedagogical practice, contributing to making teaching more dynamic, meaningful, and contextualized.

2.2 Serious Games in Accounting and Management

In the field of accounting and administration, serious games have been widely adopted as didactic resources that favor the development of professional competencies. Studies such as that of Ferreira Filho [3] demonstrate that the practice of business games, especially board games, provides an engaging experience, promoting engagement and retention of accounting content through the simulation of business environments.

Garcia et al. [4] highlight that the use of games in cost accounting education stimulates logical reasoning and analytical capacity of students, while bringing theory closer to practice. This approach also contributes to the development of interpersonal skills, such as communication and teamwork, considered fundamental for working in the field.

Another relevant example is the “Contabuleiro” game, developed based on the Design Science approach, which proved effective in promoting an interactive and collaborative learning environment, allowing students to apply accounting concepts in simulated decision-making situations [7].

In general, serious games applied to accounting and management have proven effective both in face-to-face and remote teaching, increasing student interest and favoring knowledge construction through meaningful experiences. The literature indicates that such resources, when well structured, enhance learning and assist in

training professionals better prepared for market challenges.

2.3 Gamification and Experiential Learning

Gamification consists of incorporating typical game elements — such as challenges, rewards, rankings, and narratives — into contexts that are not necessarily recreational, intending to increase participant involvement and motivation. In higher education, especially in management and accounting areas, this approach has demonstrated positive results in learning and practical competency development [5].

Kolb [6] argues that learning occurs more efficiently when the individual actively participates in the process and can reflect on their actions. Experiential learning, in this context, becomes the fundamental basis for constructing educational games that favor practice, analysis, and adaptation. The combination of gamification and direct experience with problem-solving brings the student closer to real scenarios, encouraging conscious decision-making and critical thinking.

Studies such as those of Ullah et al. [2] and Reinaldi et al. [5] show that digital games focused on financial and management education favor the understanding of abstract concepts through visual and interactive representations of everyday situations. Furthermore, interactivity allows learners to test strategies and perceive, immediately, the impacts of their choices.

Thus, by associating real challenges with game progression, the participant becomes an agent of their own learning. Well-structured gamification, combined with experiential learning methodology, contributes to training professionals better prepared to face complex financial contexts with greater autonomy and security.

3 Materials and methods

Figure 2 delineates the proposed workflow for the development of a serious game designed to impart concepts of financial administration and accounting to students in STEM fields. This methodological framework ensures a structured approach, from initial ideation to the implementation of key interactive components.

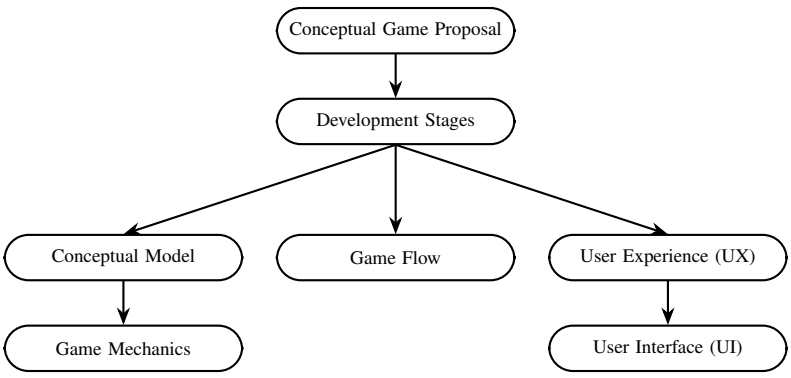


Figure 2. Conceptual workflow of the financial management simulation game development.

The workflow begins with a *Conceptual Game Proposal*, a foundational stage that establishes the project's core objectives, scope, and target audience. This proposal subsequently informs the *Development Stages*, a central node from which the primary design and production tracks diverge.

Three distinct yet parallel tracks emanate from this central stage. The first, the *Conceptual Model*, addresses the formal representation of the game's knowledge base and internal logic. This model directly underpins the formulation of the *Game Mechanics* — the specific rules and systems that constitute the gameplay. The second track, *Game Flow*, is concerned with structuring the player's progression, including the sequence of tasks, challenges, and narrative events. The third track focuses on *User Experience (UX)*, encompassing the cognitive and affective aspects of the player's interaction with the system. A key outcome of this track is the design of the *User Interface (UI)*, which serves as the tangible, interactive medium between the player and the game.

This structured methodology promotes a coherent and integrated development process, systematically aligning the educational objectives with the functional and experiential components of the final product.

3.1 Development Stages

This work details the incremental development of a serious game simulator designed to teach financial management to STEM professionals by simulating the challenges of organizing academic events. Inspired by principles of serious games [1], our methodology is structured in four main phases: (a) definition of educational objectives, (b) design of scenarios and game mechanics, (c) technical prototyping, and (d) planning of user tests.

The educational objectives focus on core concepts like budgeting, cash flow, and emergency funds, grounding the experience in Kolb's theory of experiential learning [6]. Game scenarios require players to manage realistic constraints and make strategic decisions. For instance, a player might handle a $2,000 workshop budget, choosing between hiring a $1,200 renowned speaker or a $400 alternative. These plans are then challenged by unforeseen events, such as a sponsor withdrawing funds, forcing players to adapt and learn risk analysis [2, 5].

The prototype is being developed in GDevelop, a low-code platform chosen for its accessibility and flexibility, drawing inspiration from existing accounting education games [7]. Following development, exploratory user tests are planned to gather feedback on the interface and pedagogical effectiveness, allowing for iterative refinement—a practice supported by studies on effective educational games [3, 4].

To achieve the educational goals, the gameplay is centered on three key mechanics:

- *Trade-off Decisions:* Players must constantly weigh options with clear pros and cons, such as choosing between event prestige (hiring an expensive speaker) and attendee satisfaction (offering better coffee breaks).
- *Immediate Feedback:* Decisions are instantly reflected through visual aids like cash flow graphs and overspending alerts, reinforcing the consequences of actions.
- *Unforeseen Events:* Random events test contingency planning and financial resilience, simulating real-world project management volatility.

3.2 Tools Used

The development of the game prototype is being conducted using **GDevelop**, a low-code game creation platform. This choice is based on its accessibility, flexibility, and the ability to build interactive 2D games without the need for traditional programming, which facilitates the incremental prototyping of the simulator.

The conceptual modeling of the game flow and player decisions is being carried out with the support of visual design tools. Graphical resources were used to represent the simulated phases, actions, and consequences, allowing for alignment between pedagogical objectives and game mechanics. These visual representations assist in planning interactions, educational validation, and the logical organization of the proposed experience.

Figure 3 presents a conceptual flowchart summarizing the main decisions made by the player during the event management process. Options such as seeking sponsorship, promoting the event, and hiring suppliers trigger consequences that can lead to the mission's success or failure, depending on the final financial balance.

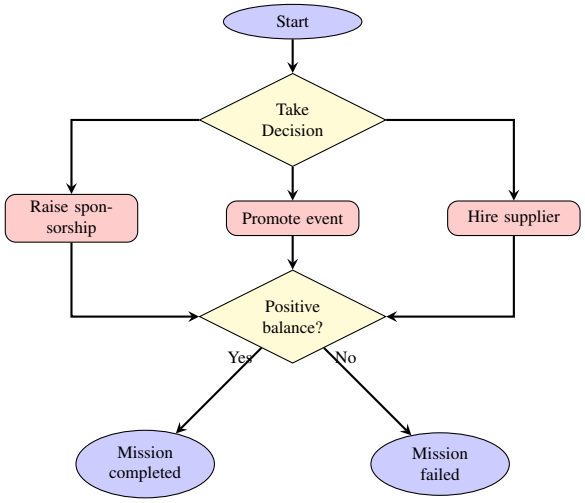


Figure 3. Conceptual flowchart of the simulator's gameplay.

Additionally, Figure 4 details the navigation structure between phases, such as the introduction, budget creation and revision, responding to unforeseen events, and simulation finalization. This flowchart allows for representing trial-and-error cycles and reinforces experiential learning mechanisms, as envisioned by Kolb [6].

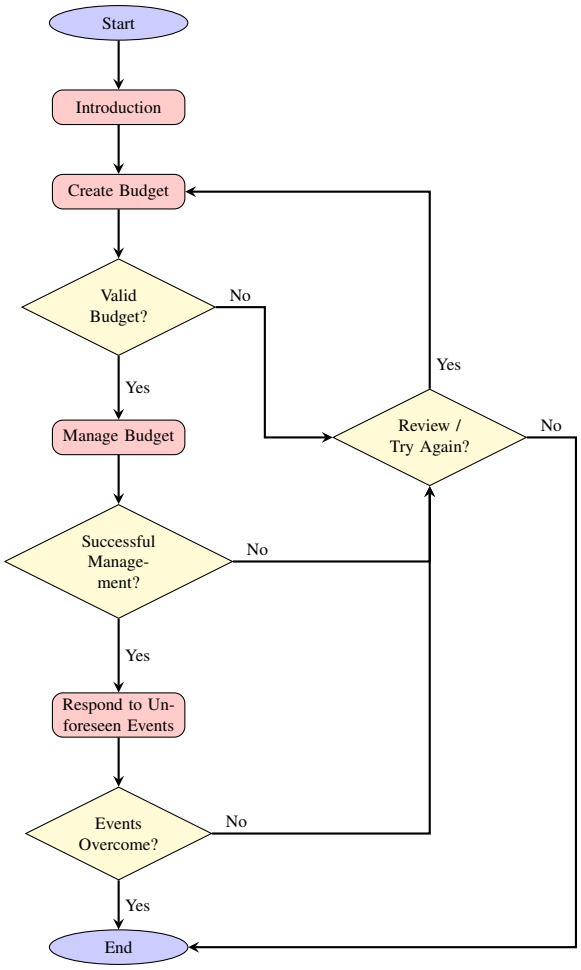


Figure 4. Detailed flowchart of the game's phases.

3.3 Target Audience and Testing Environment

The target audience for this simulator consists of students and professionals in the STEM fields who work in educational and research institutions. These individuals are frequently responsible for coordinating academic projects and events but do not always have specific training in finance or accounting, which makes the provision of an educational tool focused on practical financial management relevant.

In the university context, it is common for students to participate in organizing academic weeks, student conferences, and extension projects, assuming responsibilities related to budget planning, expense control, and accountability. This practical involvement justifies their inclusion as the simulator's target audience.

As the game is still in the incremental development phase, user tests have not yet been conducted. However, we plan to conduct in-person exploratory tests with a small group of participants representing the described target audience. The objective of these tests will be to evaluate aspects such as conceptual clarity, interface fluidity, engagement during use, and the effectiveness of the proposed challenges.

Data collection will be performed using the following strategies:

- *Structured questionnaires*, administered after the user experience, to assess perceived learning, usability, and understanding of financial concepts;
- *Direct observation*, conducted during the sessions, to identify behaviors, interaction patterns, and potential difficulties;
- *Semi-structured interviews* (optional), to gather suggestions and deepen the understanding of the participants' individual experiences.

These strategies aim to ensure feedback for the development process and align the simulator with the proposed pedagogical objectives, in accordance with the principles advocated by Laamarti et al. [1] and Kolb [6].

4 Expected Results

Given that the simulator's development is still in progress, the results presented here are expected outcomes based on the defined pedagogical objectives and the adopted methodology. It is expected that the application of the game will contribute significantly to increasing participant engagement in the learning process of financial concepts, especially those related to resource management in the context of academic events. Gamification, by incorporating elements of challenge, reward, and decision-making, should stimulate active user participation and promote greater content retention.

Preliminary testing will be conducted with 20 participants (STEM students) using a mixed evaluation protocol: (a) post-game questionnaires to measure understanding of financial concepts (Likert scale); (b) analysis of in-game decision logs (e.g., frequency of budgeting errors); and (c) semi-structured interviews for qualitative feedback. Data will be evaluated with usability metrics (e.g., SUS) and learning gains (pre/post-test).

Furthermore, it is anticipated that players who complete the simulator's missions will demonstrate a better understanding of fundamental concepts such as budget planning, expense control, building an emergency fund, and risk analysis. This hypothesis will be evaluated through the application of pre- and post-test questionnaires, seeking to identify learning gains and the perceived applicability of the acquired knowledge.

Additionally, the tests are expected to reveal the simulator's potential as a complementary teaching support tool, with the feasibility of adaptation for different user profiles within the target audience. The collected data will serve as a basis for future adjustments to the game mechanics, interface, and pedagogical progression of the missions.

5 Discussion

The expected results from the simulator's application align with the evidence presented by Laamarti et al. [1], who highlight the potential of serious games in promoting practical learning through the simulation of realistic scenarios and decision-making in controlled environments. By allowing players to assume the role of financial managers in simulated academic events, the game offers an experience that integrates theory and practice, reinforcing essential professional competencies.

The pedagogical approach also aligns with Kolb's experiential learning theory [6], which posits that knowledge is constructed from direct experience and reflection on actions taken. By enabling participants to test strategies, make mistakes, and observe the consequences of their decisions, the simulator fosters the development of skills such as planning, risk analysis, and the responsible use of available resources.

Studies by Ullah et al. [2] and Reinaldi et al. [5] show that digital games for financial and management education facilitate the understanding of abstract concepts through visual and interactive representations of everyday situations. Moreover, interactivity allows participants to test strategies and immediately perceive the impacts of their choices. Thus, by associating real challenges with game progression, the participant becomes an active agent in their own learning. Well-structured gamification, combined with the experiential learning methodology, contributes to training professionals who are better prepared to face complex financial contexts with greater autonomy and security.

However, this study has some limitations. First, the simulator is in the prototyping phase, and no user tests have been conducted yet. Initially, the evaluation will be conducted with a small group of participants, which may limit the generalizability of the results. Furthermore, as this is an incremental development, more advanced features, such as multiple player profiles or customized scenarios, have not yet been implemented.

Despite these restrictions, the proposal shows significant potential to contribute to financial education in the academic context. By offering an interactive, contextualized, and low-cost alternative, the simulator can be incorporated as a teaching resource in courses related to project management, basic accounting, or entrepreneurship, promoting the development of practical skills not always covered in traditional approaches. The initiative seeks to fill an existing gap in the training of STEM students and professionals by addressing essential topics for the financial sustainability of academic and institutional projects in an accessible and engaging manner.

6 Conclusions

This work presented the initial development of an educational simulator in a serious game format aimed at promoting financial education among STEM students and professionals, focusing on the management of academic events such as conferences, seminars, and workshops. The identified problem was the lack of practical and interactive approaches to develop competencies in budget planning, expense control, and financial decision-making in this specific context.

The proposed solution was the construction of a digital game based on realistic situations and financial challenges, developed in a low-code environment (GDevelop), with an incremental structure and a pedagogical foundation in experiential learning. The project seeks to integrate theory and practice through the simulation of interactive scenarios, reinforcing user engagement and content retention.

This work contributes to financial education in STEM through three key innovations:

- *A serious game framework* specifically designed for financial management training in STEM contexts, bridging the gap between theoretical knowledge and practical decision-making;
- *Novel gameplay mechanics* featuring immediate feedback loops that mirror real-world financial consequences, enhancing experiential learning;
- *An accessible prototype* developed using low-code technology, enabling easy adoption by institutions with limited technical resources.

The proposed solution offers more than just knowledge transfer - it provides a risk-free environment where STEM professionals can develop financial intuition through contextualized scenarios mirroring real academic event management challenges. This approach represents a significant departure from traditional lecture-based financial training methods.

As future work, we plan to: (i) conduct exploratory user tests to validate the game mechanics and conceptual clarity; (ii) refine the interface and interactions based on the feedback obtained; and (iii) expand the simulator's content to include more advanced financial topics, such as tax planning, risk assessment, and investment strategies.

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