Designing a Decision-Making Game for Children's Financial Literacy: Game Mechanics, OECD Alignment, and Empirical Evidence from Brazilian Schools

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Abstract. Introduction: *Financial illiteracy among children remains a global challenge, particularly in Brazil, where over 45% of 15-year-olds perform at or below the lowest proficiency level in the PISA 2022 financial literacy assessment.* ***Objective:*** *This paper presents JRC Game, a 2D educational platform game that teaches financial literacy to children aged 7–9 through experiential decision-making based on the OECD/INFE framework.* ***Methodology:*** *Using a Design-Based Research (DBR) approach, we mapped financial concepts—including income, investment, spending, credit, and gambling risk—into interactive game mechanics. The game was evaluated with 148 elementary school students from two Brazilian schools over 202 gameplay sessions using pre/post tests, behavioral logs, and interviews.* ***Results:*** *Participants showed significant learning gains (pre-test* $M = 8.39$*; post-test* $M = 12.40$*,* $p < 0.001$*). Behavioral data indicated a shift from gambling to investment strategies, while interviews suggested transfer of in-game learning to real-world financial reasoning and high engagement.*

Keywords *Financial Literacy, Game-Based Learning, Serious Games, Game Design, OECD Framework, Children Education.*

1. Introduction

Financial literacy is widely recognized as an essential life skill, yet millions of young people lack even basic financial competencies. The OECD defines financial literacy not merely as knowledge of financial concepts, but as the ability to make informed decisions under uncertainty, balancing short-term rewards against long-term outcomes [OECD 2024]. The challenge, therefore, is not simply teaching children what investment or saving means, but cultivating the capacity to act on such knowledge when faced with trade-offs involving risk, delayed gratification, and competing priorities. The PISA 2022 financial literacy assessment, which evaluated 15-year-olds across 20 countries, reveals the scale of the problem. On average across OECD countries, 18% of students performed below Level 2 [OECD 2024]. In Brazil, the situation is particularly alarming: over 45% of students scored at or below Level 1, and only 63%—the lowest proportion among all participating countries—agreed that they know how to manage their money [OECD 2024]. This deficit is compounded by the rapid normalization of online gambling among young Brazilians, particularly sports betting, making early financial risk education not merely a curricular objective but a public health imperative

[Calado e Griffiths 2016]. Traditional didactic approaches—lectures, textbooks, and worksheets—have shown limited effectiveness in translating conceptual knowledge into behavioral change [Kaiser e Menkhoff 2017, Amagir et al. 2018]. Financial choices in real life involve emotional regulation, temporal reasoning, and the evaluation of uncertain outcomes; they are not multiple-choice questions. Digital games offer a fundamentally different modality: simulated environments where learners make repeated decisions, observe consequences, and adapt strategies over time [Connolly et al. 2012, Hamari et al. 2016], consistent with experiential learning theory [Kolb 1984]. However, most existing financial literacy games focus on declarative knowledge through quiz-based mechanics, with few designs grounded in established competency frameworks or collecting behavioral data during gameplay [Platz e Jüttler 2025].

In this paper, we present the design, theoretical grounding, and empirical evaluation of John and the Rainbow Coins (JRC) project[1], a 2D educational platform game for elementary school children (Grades 2–3, ages 7–9). The game was designed as an experimental decision-making environment in which financial behaviors emerge through repeated interactions with controlled economic mechanics. Each mechanic is explicitly mapped to competencies from the OECD/INFE Core Competencies Framework on Financial Literacy for Youth [OECD/INFE 2015] and the EU/OECD Financial Competence Framework for Children and Youth [European Union/OECD 2023], confronting players with continuous trade-offs between consumption, investment, and gambling under time and resource constraints. We evaluated the game with 148 participants across two schools in Minas Gerais, Brazil, encompassing 202 gameplay sessions. The main contributions are: (1) a theoretically grounded game design framework mapping OECD financial competencies onto interactive mechanics for young children; (2) empirical evidence of significant financial literacy gains among Grades 2–3 students; (3) behavioral analysis showing how children's decision-making strategies evolve during gameplay; and (4) qualitative insights demonstrating that children transfer in-game reasoning to real-world financial contexts while perceiving the experience as play rather than instruction.

2. Theoretical Background

2.1. Experiential Learning and Digital Games

The pedagogical foundation of game-based learning rests on constructivist and experiential learning theories. Kolb's experiential learning cycle [Kolb 1984] describes learning as a four-stage process: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Digital games naturally enact this cycle: players act within the game environment (concrete experience), observe the consequences of their actions (reflective observation), form mental models about how the system works (abstract conceptualization), and test revised strategies in subsequent actions (active experimentation).

Dewey's [Dewey 1986] emphasis on "learning by doing" further supports the use of interactive environments for complex skills like financial decision-making. Unlike traditional instruction, which separates knowledge acquisition from application, games embed learning within the activity itself. Players do not first learn about investment

[1] https://johnandtherainbowcoins.com/

and then apply the concept; they invest, observe returns, and construct understanding simultaneously.

2.2. Game-Based Learning and Serious Games

Game-Based Learning (GBL) refers to the use of games with defined learning outcomes, where the instructional content is integrated into the game mechanics rather than presented separately [Prensky 2003]. Serious games extend this concept by designing gameplay experiences specifically to address educational, training, or social objectives while maintaining the motivational qualities of entertainment games [Abt 1970].

Research consistently demonstrates that well-designed educational games can enhance engagement, motivation, knowledge acquisition, and transfer [Connolly et al. 2012, Hamari et al. 2016]. Papastergiou [Papastergiou 2009] showed that curriculum-aligned games improve both achievement and motivation compared to conventional methods. Critically for financial literacy, games provide what Clark et al. [Clark et al. 2009] describe as "epistemic games"—environments where players adopt roles that require them to think and decide like domain practitioners.

2.3. Financial Literacy as a Competence

Financial literacy is not a single skill but a multidimensional competence encompassing knowledge, attitudes, and behaviors [Lusardi e Mitchell 2014]. The OECD defines it as the combination of awareness, knowledge, skills, attitudes, and behaviors necessary to make sound financial decisions and ultimately achieve individual financial well-being [OECD 2024]. This competence-based view implies that assessing financial literacy requires going beyond knowledge tests to examine how individuals apply their understanding in decision contexts.

The PISA 2022 framework organizes financial literacy around four content areas: Money and Transactions, Planning and Managing Finances, Risk and Reward, and Financial Landscape [OECD 2024]. Performance data reveal that mathematical and reading proficiency are necessary but not sufficient for financial literacy—across OECD countries, approximately 20% of the variation in financial literacy performance is independent of mathematics and reading scores, suggesting unique financial competencies that require targeted development [OECD 2024].

2.4. The OECD/INFE Framework for Youth Financial Literacy

The OECD/INFE Core Competencies Framework on Financial Literacy for Youth [OECD/INFE 2015] provides a structured description of the competencies needed by young people to participate safely in economic life. The framework is organized into four domains: (A) Money and Transactions, (B) Planning and Managing Finances, (C) Risk and Reward, and (D) Financial Landscape. Within each domain, competencies are described across three dimensions: (a) awareness, knowledge, and understanding; (b) confidence, motivation, and attitudes; and (c) skills and behavior.

For our target population (ages 7–9), the EU/OECD Financial Competence Framework for Children and Youth [European Union/OECD 2023] outlines key foundational skills, including understanding money's value, distinguishing needs from wants, and developing basic saving behaviors. Our game extends these competencies

by introducing simplified notions of investment and risk, bridging early financial understanding with more advanced decision-making.

3. Related Work

Several initiatives have explored how digital and analog games can promote financial competencies among young people. This section reviews representative works and positions JRC Game relative to the existing literature.

Vieira et al. [Vieira et al. 2025] presented a financial education environment built on the Roblox metaverse platform for Brazilian elementary school students. Their study explored the use of immersive and collaborative game-based learning to teach concepts such as income, savings, debt, and investments, evaluating learning outcomes through pre-, intermediate-, and post-intervention assessments.

Malee [MeemAin/GFLEC 2023] is a game-based instrument designed to measure—rather than teach—financial literacy in children aged 7–12. It captures behavioral data across five learning objectives and provides standardized measures for educators and policymakers. While Malee demonstrates the feasibility of using games as assessment instruments, it does not address the teaching of financial decision-making under risk, nor does it target children in the earliest elementary grades.

Platz and Jüttler [Platz e Jüttler 2025] conducted an experimental study with 293 secondary school students investigating how game mechanics and reflection prompts affect attitudes toward financial planning. Their 2×2 factorial design found that strategic decision mechanics increased autonomy and competence satisfaction; however, no significant effects on financial attitudes were observed. The study underscores that adding complex mechanics alone does not guarantee attitudinal change, highlighting the need for designs that go beyond engagement to target behavioral outcomes.

The Cha-Ching Money Adventures evaluation [Educational Development Center 2023] tested a digital game with 293 children aged 8–9 in the Philippines using a randomized controlled trial. The experimental group showed significantly higher post-test financial literacy scores and increased family discussions about money. This study confirms the potential of games for young children but relied exclusively on pre-/post-test measures without analyzing in-game behavioral patterns.

Yi et al. [Yi et al. 2025] conducted a pilot study with 77 primary school students in Malaysia combining board games and hands-on activities across four workshops over ten months. Students learned to differentiate needs from wants and compare value-for-money, but the intervention did not address digital decision-making under risk or collect in-game behavioral data.

Alamin et al. [Alamin et al. 2025] proposed an adaptive game-based learning model incorporating the ARCS motivational framework, tested with 63 Indonesian secondary students. Results showed improved motivation and concept retention, but the evaluation relied on questionnaires rather than capturing financial choices during gameplay.

As Table 1 summarizes, JRC Game is the only design that simultaneously targets early elementary students (ages 7–9), incorporates decision-making under risk as a core

Table 1. Comparison of financial literacy games with JRC Game.

Work	Age	Risk	OECD	Behav.	Study	Pre/Post
Malee [MeemAin/GFLEC 2023]	7–12	No	Partial	Yes	No	No
Platz & J. [Platz e Jüttler 2025]	15–18	No	No	No	Yes	No
Cha-Ching [Educational Development Center 2023]	8–9	No	No	No	Yes	Yes
Yi et al. [Yi et al. 2025]	7–12	No	No	No	No	No
Alamin et al. [Alamin et al. 2025]	15–18	No	No	No	Yes	Yes
JRC Game	**7–9**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

mechanic, aligns with the OECD/INFE framework, collects in-game behavioral data, and evaluates outcomes through a controlled study with pre- and post-tests.

4. Method

This section describes the game design rationale, mechanics, experimental procedure, and data collection instruments. We adopted a Design-Based Research (DBR) approach [Barab e Squire 2004], in which the game serves both as a pedagogical intervention and as a research instrument for investigating children's financial decision-making.

4.1. Game Design Rationale

The game was designed as a decision-making environment grounded in financial literacy theory, particularly focusing on trade-offs between three fundamental financial behaviors: consumption (spending for immediate benefit), investment (allocating resources for delayed returns), and risk-taking (gambling with uncertain outcomes). This triadic model reflects the core tension in personal finance education: learners must develop the capacity to evaluate competing options that differ in expected return, temporal delay, and uncertainty.

Rather than treating financial concepts as content to be transmitted, we operationalized them as mechanics to be experienced. Each game mechanic corresponds to a specific competency from the OECD/INFE framework [OECD/INFE 2015], ensuring that gameplay generates behaviors aligned with recognized financial literacy domains. Table 2 presents this mapping.

4.2. Game Mechanics and Environment

JRC Game is a 2D side-scrolling platform game built in Unity and deployed via WebGL for browser-based access. Each gameplay session lasts 15 minutes, during which the player's objective is to maximize accumulated wealth through a combination of exploration, resource collection, and financial decision-making.

The game environment provides repeated opportunities for financial decision-making under time constraints. At each moment, players choose among actions that differ in expected return, risk level, and temporal delay. The core mechanics include: (1) collecting coins scattered across the platformer level, providing a baseline income stream; (2) investing collected coins in short-, medium-, or long-term financial instruments with configurable interest rates and maturation periods; (3) purchasing items from in-game shops to gain advantages (e.g., bypassing obstacles), requiring cost–benefit evaluation; (4) gambling at a casino with slot machines featuring a configurable Return-to-Player (RTP) percentage that ensures a negative expected value over time; and (5) using

Table 2. Mapping of financial concepts to game mechanics and OECD/INFE domains.

Concept	Game Mechanic	OECD/INFE	Competence
Income	Collecting coins	Money & Transactions	Recognizing income sources
Investment	Investments with configurable rates and duration	Risk & Reward; Planning	Evaluating return vs. time
Spending	Buying items to overcome obstacles	Money & Transactions; Planning	Distinguishing needs from wants
Gambling	Slot-machine casino	Risk & Reward	Understanding probability and loss
Credit	Credit card with interest	Planning; Financial Landscape	Managing debt and interest
Saving	Bank account	Planning & Managing	Accumulating resources

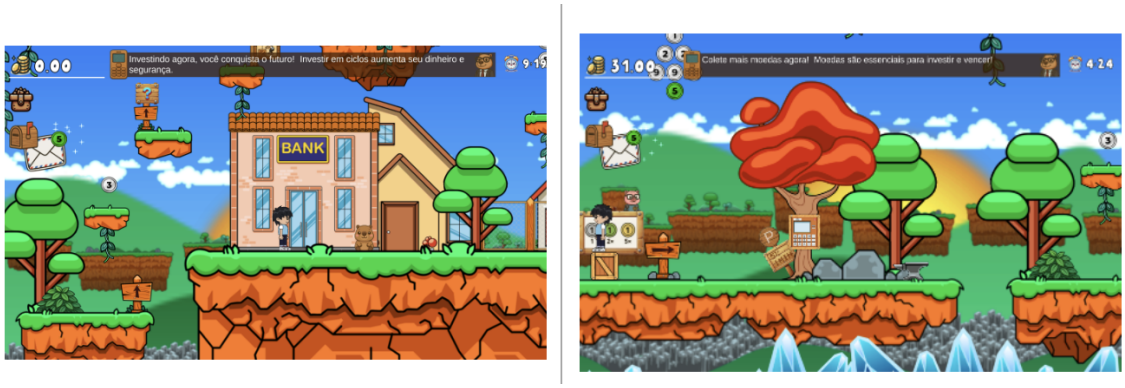

Figure 1. Images of the JRC Game

a credit card system that enables spending beyond the current balance, with interest accruing at a fixed rate per minute and periodic billing cycles.

The level design was generated with the assistance of Generative AI (GPT-4o-mini) to create varied and engaging scenarios. The game also incorporates AI-driven algorithms for real-time adaptation and personalized natural language feedback; however, the detailed description of these computational systems is outside the scope of this paper, as the present focus is on the game design process and educational outcomes. The AI-based components are reported in complementary publications [Santos et al. 2026].

4.3. Decision Space

A distinguishing feature of JRC Game is the explicit treatment of gameplay as a structured decision space. At any point during a session, the player's state can be characterized by their current balance, outstanding debt, inventory, and remaining time. The available actions—invest, spend, gamble, collect, save, or use credit—each carry distinct expected

values, risk profiles, and temporal characteristics. The player's final wealth serves as the primary outcome variable, providing a unified metric that reflects the cumulative quality of financial decisions made during the session.

This framing allows the game to function as what Shute et al. [Shute et al. 2009] describe as an "evidence-centered" assessment environment: every player action generates observable evidence of financial competence without requiring explicit test items that would disrupt the gameplay experience.

4.4. Data Collection

The game system automatically logs every player action as a structured event containing the event type, description, monetary amount, item involved, current balance, current debt, and remaining time. From these event logs, we derive behavioral metrics for each session, including gambling frequency, total earnings, investment frequency and amount, credit card usage, spending on items, and final balance. These metrics enable the analysis of individual decision-making patterns and their evolution across sessions. Following the methodology proposed in [Santos et al. 2024], we further cluster players based on their behavioral profiles to identify distinct financial decision-making patterns.

In addition to in-game data, learning outcomes were assessed through a 15-item multiple-choice pre- and post-test aligned with youth financial literacy frameworks [OECD/INFE 2015], covering saving, investing, compound interest, credit management, and risk evaluation. Semi-structured qualitative interviews were conducted with randomly selected participants to capture perceptions about the gameplay experience and financial learning.

4.5. Experimental Procedure

The study was conducted with 148 elementary school students (Grades 2–3, ages 7–9) from two schools in a large city in Minas Gerais, Brazil, encompassing six classrooms (three per school). Sessions occurred during regular school hours, with 10–12 children playing simultaneously on individual devices for 15 minutes per session. Over the course of the experiment, 202 gameplay sessions were logged, with participants completing multiple sessions based on classroom availability.

All sessions were supervised by school staff and trained researchers who ensured protocol adherence and consistent session duration. The pre-test was administered before the first gameplay session, and the post-test was administered after the final session. Qualitative interviews (approximately 5 minutes each) were conducted with randomly selected participants from each classroom.

The study received approval from the university's Ethics Committee (CAAE: 78520523.0.0000.5152). Informed consent was obtained from all parents and guardians, and children were informed of their right to withdraw at any time. Data confidentiality and anonymity were maintained throughout the study.

5. Results

5.1. Learning Outcomes

Pre- and post-test analysis revealed substantial and statistically significant financial literacy gains across the participant sample. The mean pre-test score was $M = 8.39$

($SD = 1.92$) and the mean post-test score was $M = 12.40$ ($SD = 1.82$), representing a 47.8% improvement on a 15-point scale. A paired-samples analysis confirmed that this difference was statistically significant ($p < 0.001$), with a large effect size ($\eta_p^2 = 0.719$). These results indicate that the game-based intervention produced meaningful learning gains in financial literacy concepts including saving, investing, risk assessment, and credit management.

Notably, the gains were observed across both schools and all six classrooms, with minimal clustering effects (ICC < 0.01), suggesting that the learning outcomes were driven by the game intervention itself rather than by school- or teacher-level differences.

5.2. Behavioral Patterns

Analysis of the 202 gameplay sessions revealed distinctive behavioral patterns in children's financial decision-making. Early sessions were characterized by exploratory behavior, with higher gambling frequency and lower investment rates. Across subsequent sessions, a clear shift emerged: children progressively reduced their gambling frequency and increased their investment activity, suggesting an experiential learning trajectory consistent with Kolb's model.

Three broad behavioral clusters were identified: (1) *Risk-seekers*, who maintained high gambling frequency throughout sessions and tended to accumulate less wealth; (2) *Balanced strategists*, who distributed actions across investing, spending, and moderate gambling, achieving intermediate wealth outcomes; and (3) *Conservative investors*, who concentrated on coin collection and investment, minimizing gambling, and achieving the highest final balances. The proportion of children in the conservative cluster increased across sessions, indicating behavioral adaptation through gameplay experience.

The average number of gambling instances decreased from the first to subsequent sessions, while the average amount invested increased, providing quantitative evidence that the game's mechanics effectively conveyed the superiority of investment over gambling as a wealth-building strategy.

5.3. Qualitative Findings

Semi-structured interviews with randomly selected participants yielded rich insights into how children perceived the game experience and the financial concepts embedded within it. Several themes emerged from the qualitative analysis.

Transfer to real-world reasoning. Multiple children spontaneously connected in-game experiences to real-life financial contexts. One participant stated: *"I learned that in gambling games you can even win now but then you lose everything."* Another expressed the intention to share what they learned: *"I'm going to teach my dad that if he puts money in investments, he can earn more."* A third demonstrated understanding of credit: *"I learned that we need to be very careful when using the credit card—it's not extra money."*

Perception as play, not instruction. The majority of participants did not perceive the activity as a formal class. Representative statements included: *"I really like these classes because it's about playing video games"* and *"I like controlling the character and making decisions in the video game."* This finding is pedagogically significant because it

indicates that the game successfully embedded financial instruction within an intrinsically motivating activity, reducing the affective barriers that often accompany formal financial education.

Learning through experimentation. Several children described a trial-and-error learning process: *"I kept trying to see what gave me more money in the game and I learned a lot of things by trying."* This aligns directly with the experiential learning framework that informed the game's design.

Challenges and accessibility. Some participants reported initial difficulty with game controls, particularly those without prior gaming experience: *"I found the game hard to play"* and *"In the beginning it was very hard but then I got the hang of it."* Others found the 15-minute session duration insufficient for their strategies to fully materialize: *"When I started to understand, the time was up"* and *"I didn't have time to collect my investments."* A few students also experienced difficulties with basic mathematical concepts underlying the game mechanics, suggesting that basic numeracy is a prerequisite that educators should address prior to gameplay sessions.

6. Discussion

The empirical evidence from this study strongly supports the effectiveness of JRC Game as a tool for teaching financial literacy concepts to young children. The 47.8% improvement in pre- to post-test scores, achieved with children as young as seven, demonstrates that game-based experiential learning can produce meaningful financial literacy gains even among learners who have had no prior formal financial education.

The behavioral data provide a particularly compelling contribution. Unlike studies that rely solely on declarative assessments, our in-game logging captured how children actually behaved when confronted with financial trade-offs. The progressive shift from gambling-heavy to investment-oriented strategies mirrors the learning trajectory that financial literacy education aims to produce: children learned not only that investment is preferable to gambling but demonstrated this understanding through their actions. This behavioral evidence addresses a persistent criticism of financial literacy interventions—namely, that knowledge gains do not reliably translate into behavioral change [Kaiser e Menkhoff 2017].

The qualitative findings further enrich this picture. Children's spontaneous references to real-world financial situations—teaching parents about investment, recognizing credit card risks, understanding gambling losses—indicate that the game fostered not merely procedural understanding but genuine conceptual transfer. The fact that most children perceived the activity as play rather than formal instruction is a significant design achievement: it suggests that the financial content was sufficiently integrated into the game mechanics to avoid the "chocolate-covered broccoli" phenomenon, where educational content is superficially layered onto gameplay without meaningful integration [Bruckman 1999].

These findings are especially relevant for the Brazilian context. With over 45% of 15-year-olds performing at or below Level 1 in PISA's financial literacy assessment and the rapid proliferation of online gambling among younger populations, early interventions that develop both financial competence and risk awareness are urgently needed. Our

results suggest that game-based approaches can reach children as young as seven years old effectively, establishing foundational financial reasoning years before the deficits captured by PISA assessments become entrenched.

The design challenges identified through qualitative data also offer practical guidance. The initial difficulty experienced by children without gaming experience suggests that brief tutorial sessions should precede the main intervention. The time constraint issue points to a potential design improvement: allowing flexible session durations or including visual indicators of investment maturation timelines to help children plan their strategies more effectively.

The alignment with the OECD/INFE framework provides a structured basis for curriculum integration. Because each game mechanic maps to a recognized financial competency domain, educators can use JRC Game as a complement to broader financial education programs, with clear visibility into which competencies are being exercised during gameplay.

7. Conclusion

This paper presented JRC Game, a 2D serious game that teaches financial literacy to children in Grades 2–3 through experiential decision-making. Grounded in the OECD/INFE financial literacy framework, the game challenges players to balance consumption, investment, debt, and risk through interactive gameplay.

An evaluation with 148 Brazilian elementary school students demonstrated: (1) significant improvements in financial literacy; (2) measurable shifts from risky to more strategic financial behaviors; and (3) evidence of transferring acquired concepts to real-world reasoning. The game also integrates AI for adaptive difficulty and personalized natural-language feedback, which are discussed in complementary publications.

Overall, our findings reinforce the potential of serious games as engaging and effective tools for financial education, particularly in contexts where financial literacy remains limited.

7.1. Future Work

Future work includes extending the game for older students (ages 16–18), introducing more advanced financial concepts, enhancing AI-driven adaptation, incorporating intelligent NPCs for financial guidance, evaluating long-term knowledge retention with larger and more diverse populations, investigating individual differences (e.g., prior mathematics and gaming experience), and further examining the ethical implications of educational gambling mechanics

Acknowledgements.

We thank Diogo Abílio de Alcantara for the game design; our partner schools, ESEBA and Objetivo, in Uberlândia - MG/Brazil, for supporting the validation study; ADASYS Game Club (Federal University of Uberlândia) for deployment assistance; Professor Stéphane Julia for coordinating the outreach activities; and CNPq (Grant #302833/2025-0) and CAPES for their financial support.

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