Metaverse 2025, 6(1), 3222.
https://doi.org/10.54517/m3222

Asia Pacific Academy of Science Pte. Ltd.

Article

A Metaverse-based approach for financial literacy in Brazilian vocational school

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CITATION

Vieira RM, da Silva AP, Damasceno EF. A Metaverse-based approach for financial literacy in Brazilian vocational school. Metaverse. 2025; 6(1): 3222. https://doi.org/10.54517/m3222

ARTICLE INFO

Received: 14 January 2025
Accepted: 21 February 2025
Available online: 3 March 2025

Abstract: This article proposes a pioneering approach to teaching Financial Education in Brazilian schools by leveraging the immersive world of Metaverse Games, specifically within the Roblox platform. Financial literacy is a critical global skill, yet making it captivating for students is a challenge. Our Roblox-based educational space creatively demystifies complex financial concepts such as assets, salary, income management, savings, debts, and investments. To assess the impact, we administered three questionnaires: a pre-test to determine initial knowledge, an intermediary test during digital interaction, and a post-test to evaluate knowledge retention. Results indicate that Roblox effectively engages students with financial content in a fun and interactive way. The Metaverse represents a new frontier for educational technology, prompting the development of innovative assessment and learning management strategies. Despite observing impulsive decision-making in the virtual setting, students adopted a cooperative approach to improving outcomes through the reset function of the game, highlighting a collective learning experience. Our research concludes that financial literacy is essential for young individuals to manage real-life finances and that collaborative learning significantly boosts skill acquisition. It is, therefore, crucial to universally adopt playful and cooperative financial education in schools to prepare students for financial success in their personal lives and future society.

Keywords: Finance Education; Metaverse in education; game-based methodology

1. Introduction

Financial Education (FinEd) has recently gained prominence in Brazil due to its influence on individual behavior and its role in fostering skills and knowledge for financial well-being [1]. Given the complexity of the economic landscape and the direct impact of financial decisions on personal quality of life, it is essential for 21st-century education to introduce students to these concepts [2].

Various teaching methods and strategies for FinEd exist, including those that engage students through words, reflections, and actions [3], aimed at empowering students to support democracy and to apply simplified models of reality to validate personal financial judgments [4]. Researchers continually seek the most effective strategies to address the challenges in teaching financial literacy [5].

Financial education is an integral training recommendation and should be an essential pillar for the socio-economic development of any nation [6]. In Brazil, encouraging financial education can bring a series of benefits that impact both the

individual lives of citizens and the economy as a whole.

The schools are critical in promoting FinEd as they cultivate critical and aware citizens. It can be achieved by teaching financial concepts in the classroom or employing strategies that enhance students' critical thinking about money management. It is also recognized that incorporating FinEd into the school curriculum helps develop positive and rational attitudes toward money and is vital in preventing financial issues in adulthood [7].

So, exploring the most diverse ways of promoting financial education in Brazil is necessary to cultivate a better-informed society and better prepared to face contemporary economic challenges [8]. Considering that most Brazilians lack basic financial knowledge, it is common to find this population falling into a vicious cycle of debt and irresponsible consumption, leading to problems such as default and family economic instability [9]. By equipping students as aware citizens with an understanding of budget management, investments, credit, and risk, Brazil can foster a culture of saving and investment, which is essential for sustainable economic growth. Thus, engaging adolescents and young adults in a more motivating and practical exploration of financial education, which is intriguing yet often poses a significant teaching challenge, is of utmost importance [10].

2. Brazilians Finance Education

Financial Education (FinEd) has become a critical component of modern society's educational process, empowering individuals with the skills necessary for making informed and conscientious financial decisions [11]. Its importance lies in cultivating essential abilities for personal financial management [12].

Introducing foundational financial and economic concepts in schools is a pedagogical strategy that provides students with essential financial knowledge and encourages a critical understanding of prevalent economic information in society [13]. This approach is crucial for laying the groundwork for a balanced and responsible financial life, preparing future adults to navigate financial challenges with insight and confidence [14].

In 2005, the OECD issued primary and secondary education guidelines, including the Financial Education Project, to assess financial proficiency among its member countries [15]. However, the suggestion for partnerships with banks in resource-limited countries was controversial due to potential conflicts of interest related to bank profits [16]. Nonetheless, financial education is intended to enhance individual financial health and collective well-being.

Brazil embraced this educational shift with the implementation of the National Financial Education Strategy (ENEF) in 2010, followed by the amendment to the National Education Guidelines and Bases Law in 2017, which mandated the inclusion of Financial Education in the curricula of primary and secondary education [17]. The 2017 National Common Curricular Base (BNCC) further supports this, advocating for the integration of economic and financial concepts within elementary mathematics and across other subjects, covering topics like interest rates, inflation, and investments to nurture essential financial literacy for citizenship [18].

FinEd instruction in Brazil covers percentages, interest, discounts, cash payments, installment payments, debts, and capitalization, which are of daily relevance and help build students' financial acumen [19]. The project addresses personal finance and decision-making, budget organization and management, mid to long-term financial planning, social security, general population engagement in the economic system, investments for a more comfortable financial future, debt renegotiation, and eco-friendly products and sustainability. These themes align with the project's focus areas of Financial Planning and Budgeting, Debt Management, Emergency Savings, and Investments [20].

The next step involves integrating economic and financial education into the curricular frameworks of core subjects, utilizing Game-Based Learning as an innovative pedagogical tool. The project emphasizes interactive and dynamic activities designed for virtual environments and leverages gamification to engage students.

Digital games are well-known for their motivational and engagement capabilities, and their use in education has proven effective in fostering participatory and meaningful learning [19,21]. Through gamification, the project harnesses the motivational qualities of games to enhance student engagement and facilitate the understanding of economic and financial concepts.

2.1. Brazilian pedagogical approaches

In **Figure 1**, we show the timeline of various researchers' approaches in equipping and intervening in Basic Education to address Financial Education; this study focused on a maximum span of 10 years (2014–2024). The progression was limited to one investigation per researcher year, emphasizing novel findings. Thus, we see a chronological analysis of the leading approaches utilized in Brazilian schools to equip public and private school students with financial literacy:

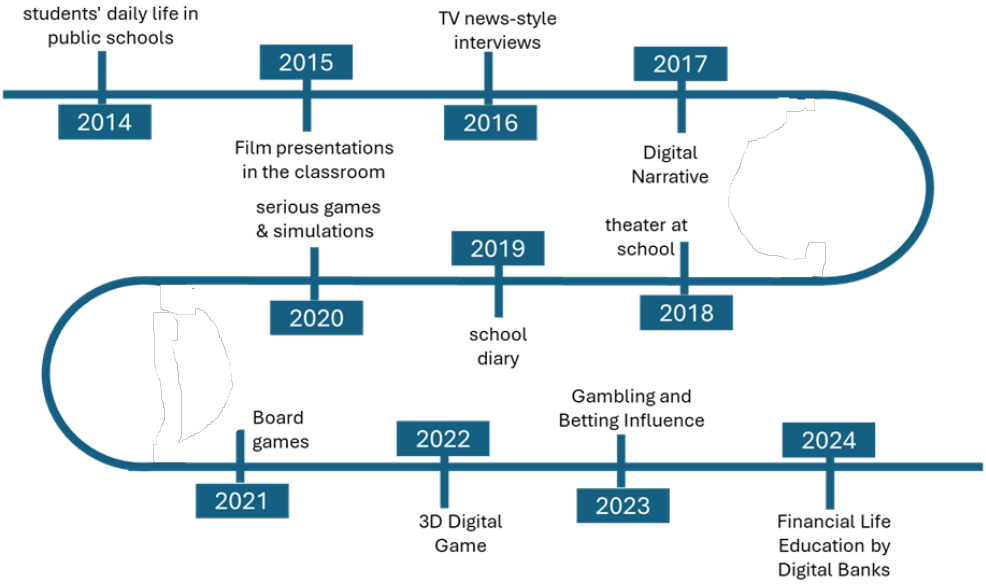

Figure 1. Timeline of Brazilian pedagogical approaches.

In 2014, the first substantial reflection on Financial Education (FinEd) was undertaken, contextualizing it within adolescents' daily lives in a public elementary school [22]. This initial study highlighted the importance of integrating financial literacy into the school curriculum to prepare young students for real-life financial decisions. Building upon this foundation, in 2015, a new strategy was introduced that leveraged films illustrating the consequences of inadequate financial or life planning. This innovative approach targeted first-year high school students to enhance their awareness and understanding of financial management and long-term planning [23]. The films were selected for their relatable narratives and practical examples, facilitating a more engaging and impactful learning experience for the students.

Another approach involves children from elementary education creating and disseminating news reports on YouTube, focusing on financial planning and budgeting [24]. In 2017, the digital trend influenced education by using the Jclic software to develop learning objects on FinEd [25].

Otherwise, in 2018, it highlighted a playful strategy using Theater in the classroom [10], followed by a didactic guide for teacher training in 2019 [26].

The research of 2020 featured the creation of a 2D Serious Game for FinEd [16], while 2021 introduced a board game for grades 7–9 [27]. The leap to a 3D virtual environment for high school education was presented in 2022 [28].

As digital currency and the digital economy rise in discussion, 2023's highlighted work addresses digital betting games' impact on education [29, 30]. Closing the analysis, 2024 showcases insights on using digital banks, the intersection of financial education with digital behavior [4], and financial debt implications from gambling awareness in schools [31].

The school initiatives are predominantly in public institutions (90% of reported approaches), with 78% at the basic education level and only 7% in private schools [30]. Furthermore, approximately 87% of scholars' research refers to basic education, aligning with BNCC guidelines. The study indicates a strong tendency for schools to implement financial education projects, integrating the subject transversally into curricula.

Recurring initiatives in schools include topics related to payment methods, consumer protection, conscious consumption, and financial management tools. Salary use, entrepreneurial behavior, and educational discussions around news from widely circulated newspapers and magazines are addressed through analog or digital games. There are also efforts concerning financial behavior change, family organization, consumption versus consumerism, and savings.

However, there is a notable absence of applications leveraging educational Metaverse technology or online multiplayer/multiuser games as teaching strategies. This work, therefore, introduces an innovative educational approach with the potential to enhance student engagement in financial education tasks.

Within the Metaverse, students and teachers can share a common virtual space regardless of their physical presence in a real-world classroom [32]. These virtual worlds' graphical representations and interaction methods aim to emulate complex human relationships, fostering highly valued socio-interactions in contemporary

education [33].

Digital games like these are considered Metaverse prototypes due to their distinguishing features that surpass the traditional concept of digital games or social networks, possessing unique aspects that warrant consideration [34]. Moreover, eight foundational pillars underpin the Metaverse: identity, socialization, immersion, low latency, diversity, ubiquity, economy, and civility [35]. Thus, a new educational environment is emerging with novel forms of interaction, assessment, and reflection on its use.

Furthermore, the Metaverse allows students to use portable devices to access the educational environment without time or location constraints, interacting in real-time with various elements, such as avatars, intelligent NPCs, or virtual learning resources [36]. This interaction provides a sense of presence akin to a real-world educational setting. From this perspective, applying the Metaverse in education could pave the way for a range of exceptional learning experiences for students.

3. Metaverse-based education

The Metaverse concept is not a novelty of the 21st century; it dates back to the late 20th century, specifically 1992, as a feature in a science fiction novel [37]. Since then, the Metaverse has been computationally realized, notably through systems like Second Life, which refers to a virtual universe where graphic computing allows individuals to interact and socialize using avatars, with interaction devices ranging from conventional to innovative, such as joysticks.

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These virtual environments emerge as promising social and educational platforms for teaching and learning; challenging traditional models focused on summative assessments. Metaverses offer a dynamic setting that enables continuous tracking of student progress, promoting the implementation of formative assessments tailored to individual learning needs.

In this educational context, the Metaverse presents innovative opportunities by providing concurrent access to a virtual world that influences the real world and is available to the school community at any time or location.

In the early 2000s, multiuser RPG gaming communities such as Second Life (launched in 2003) and World of Warcraft (launched in 2004) began attracting millions of users, establishing themselves as precursors to today's understanding of the Metaverse. However, they did not sustain the same level of interest in subsequent years [38].

By the second decade of the 21st century, various online platforms following this trend regained popularity, with Roblox standing out. Roblox is an open-world (sandbox) game that allows users to create virtual worlds and interact in real time with others [39].

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4. Research design

This study employs a "quasi-experimental" approach, recognized for its effectiveness in educational contexts where complete control over variables is impractical [40]. As an academic environment, this design is well-suited for teaching settings.

4.1. Population and sample

The research will be conducted with students enrolled in a vocational high school program in the countryside of São Paulo state, Brazil. The sample comprises 36 vocational school students aged between 14 and 19 who cannot be considered experts in Metaverses but are users of digital games and online digital communities. All the subjects of this research were invited to participate freely and spontaneously provided their data for analysis.

Fairness will be ensured, and any perception of favoritism will be avoided by randomly selecting participants to form two separate groups: the experimental group, engaged with the Roblox metaverse, and the control group, which will continue with traditional teaching methods. This random selection will be conducted to guarantee impartiality in assigning students to their respective groups.

4.2. Study instrument

The research design includes the application of a pre-test aimed at identifying students' prior knowledge and a post-test designed to measure the impact of the intervention on learning. Data collection and analysis of the results from the experimental group will be conducted, enabling the application of the intervention to the control group and ensuring no group is disadvantaged during the process.

This approach not only fosters ethical equity in research development but also secures methodological rigor, allowing for the verification of changes or effects resulting from the interventions through established pre-test and post-test strategies. The implementation of this methodology underscores a commitment to research ethics and transparency in educational analysis procedures.

A valuable pre-test and post-test questionnaire was utilized in this research to ascertain whether a new approach had indeed made a difference in learning or performance. These tools help measure progress and the impact of the intervention. However, certain precautions need to be taken for these outcomes to be reliable.

For instance, it is necessary to prevent participants from merely recalling questions from the prior test or allowing external factors such as fatigue or mood changes to influence the results. The tests must also be well-constructed and validated to measure the intended concepts accurately. Moreover, questions should be clear and straightforward to prevent confusion or misrepresented answers, ensuring fair and precise evaluation.

The research instrument consists of three questionnaires: the first being a conceptual pre-test on financial education, the second addressing usability, user satisfaction, gameplay, engagement, motivation, acceptability, and overall learning [41], and the last one being a post-test [42].

Although gaming activities are highly valuable for teaching, it is only through laboratory experimental studies that a perspective on the validity of learning can be provided. Affective experiences regarding the object (Roblox) and the relationship between different levels of player skills will be disregarded to fit the natural exploratory context. Hence, the necessity for analyzing the experimentation at three different points arises, as in an actual classroom setting, the heterogeneous profiles of students in terms of object use and understanding (Roblox) could result in uncontrolled observations.

The post-test questionnaire will assist in identifying the educational impact of the game and in gathering feedback for potential enhancements. Responses from the post-test can also be compared with those from the pre-test to gauge knowledge growth and changes in participants' attitudes.

4.3. Data analysis methods

In this study, data analysis prioritizes the validation and alignment with our research objectives. Therefore, the three questionnaires were evaluated to illustrate the outcomes in Section 5. The statistical analysis was performed using Microsoft Excel, a software extensively utilized by scientists for data collection, calculation, and analysis. This software's utility stems from its capacity to rapidly develop custom-designed spreadsheet templates and the ability to construct sophisticated and highly customizable macros using Excel Visual Basic for Applications (VBA).

Furthermore, it is anticipated that subsequent phases of the research will incorporate advanced content analysis methodologies to scrutinize the participants' feedback meticulously. The primary objective of this analysis will be to systematically identify and characterize any inconsistencies or impediments within the dataset that may reflect underlying behavioral patterns or learning obstacles.

4.4. Experimental study design

In our scholarly contribution, we introduce our experimental framework's prototype and accompanying visual representations. The development of this virtual educational environment was meticulously tailored to cater to Brazilian learners'

cognitive and interactive needs within the age cohort of 14 to 19 years. As depicted in **Figure 2**, our Metaverse emulation's structural phases mirror Roblox's architectural paradigm, a platform familiar to our target demographic.

a) Relation between the Value of the Toy and the Currency

b) Understanding inflation in products

c) Economy Identification Status and Emergency Reserve

d) Interest rate search and credit selection

Figure 2. Roblox Metaverse finance approach level design (*screens in Portugues*).

Participant engagement within the research is contingent upon manipulating the user interface. Upon activation of the "Start game" command, the experimental sequence is initiated, and retrogression in the simulation becomes infeasible. Given the open-world nature of our project, we have engineered various virtual spaces amalgamated into the game structure. Access to these spaces is conditional upon the participants' responses to posed inquiries, with the correctness of their answers directly influencing their in-game currency balance through accrual or forfeiture.

Throughout each experimental iteration, or 'round', participants confront scenarios reflective of real-life situations, demanding the application of rational decision-making and the prudent management of financial assets. This immersive educational activity is designed to be completed within approximately 15 min and offers the flexibility for repeated trials. Such iterations allow subjects to explore alternative outcomes or reassess their decision-making processes compared to previous engagements with the simulation.

5. Initial results and outcomes

We present the preliminary results of an investigation focused on two essential questions illustrated in **Figure 3**. The comparison involves the experimental and control groups across two key areas: the perception of mindful financial use strategies and the practicality of financial education in everyday life.

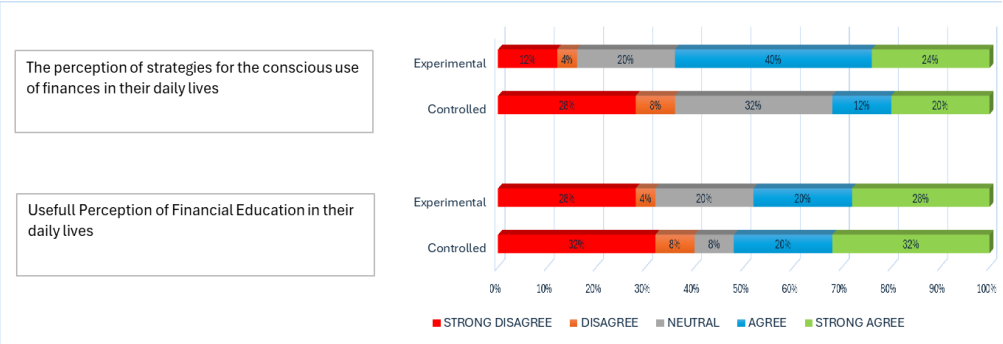

Figure 3. Student's educational process percptions.

In the experimental group, which engaged with the Roblox Metaverse, 64% of participants expressed a positive perception regarding financial strategies, with 40% agreeing and 24% strongly agreeing. Meanwhile, 20% maintained a neutral stance, and only 16% disagreed, with 12% strongly and 4% mildly. The control group, which followed traditional teaching methods, showed a less enthusiastic response, with 52% agreeing positively (32% agreed and 20% strongly agreed), 12% neutral, and a notable 36% disagreeing (28% strongly and 8% mildly).

Our investigation reveals intriguing insights into how game-based learning environments influence perceptions and practical understanding of financial strategies among students. The data indicate that participants who engaged with FinEd through Roblox demonstrated a more positive perception of mindful financial strategies than those who underwent traditional teaching methods. We believe that suggests that game environments' immersive and interactive nature can lead to more impulsive yet potentially insightful decision-making, mirroring the quick-thinking scenarios often encountered in real-world financial situations.

Regarding the perceived usefulness of financial education in daily life, 48% of the experimental group found it applicable, with 28% strongly agreeing and 20% agreeing, whereas 20% were neutral, and 32% disagreed (28% strongly and 4% mildly). The control group exhibited a slightly higher positive perception, with 52% considering financially helpful education (32% strongly agreed and 20% agreed), only 8% neutral, but 40% disagreed (32% strongly and 8% mildly).

The observations indicate that the experimental group had a more robust understanding of financial strategies but was marginally less convinced of financial education's utility than the control group. Notably, the control group displayed higher levels of dissent, particularly around the strategies for financial management.

In the real world, financial decisions—whether to take out a loan, invest in the stock market, or save for the future—often require a balance between intuition and careful analysis. Our Metaverse seems to sharpen the intuitive aspect, fostering a robust understanding of financial strategies by allowing students to experiment and observe the immediate consequences of their decisions. This experiential learning resembles financial dealings' psychological pressures and rewards, where impulsive but educated responses can sometimes be beneficial.

These findings suggest that the educational programs utilizing Roblox, as exemplified by the experimental group, have the potential to significantly shape

positive perceptions of financial strategies and the value of financial education. However, the study also highlights areas requiring enhancement, particularly neutral and negative responses, to optimize the educational impact.

However, the study also reveals that the experimental group was marginally less convinced of the everyday applicability of financial education. This nuance underscores the importance of engaging learners and ensuring that the educational content is directly relevant and practical for everyday use. The control group's higher dissent regarding financial management strategies implies that traditional methods may still hold value in conveying the applicability of financial education in real-life contexts.

The investigation extends to using Roblox as an educational medium, an area that has piqued the interest of scholars and teachers alike. **Figure 4** captures the perceptions related to content reliability and the platform's aesthetic appeal in learning scenarios.

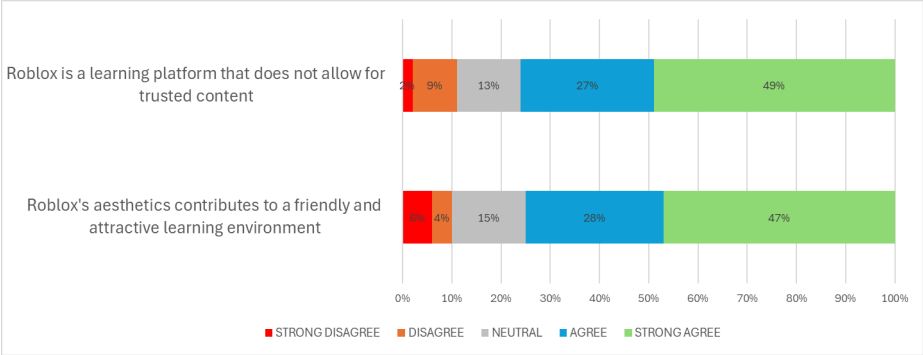

Figure 4. The Roblox use perceptions.

For the statement concerning content reliability on Roblox, "Roblox is a learning platform that does not allow for reliable content", 76% of participants agreed or strongly agreed, with percentages of 27% and 49% respectively. Only 2% strongly disagreed, 9% disagreed, and 13% remained neutral. This suggests a primary concern over the trustworthiness of content available on Roblox, highlighting a significant barrier to its acceptance as a credible educational resource.

In contrast, "The aesthetics of Roblox contribute to a friendly and attractive learning environment" received broader approval. 75% of participants agreed with the statement, 47% strongly agreed, 28% agreed, 6% strongly disagreed, 4% disagreed, and 15% remained neutral. This indicates that Roblox's visual and interface design is generally conducive to creating an engaging educational setting.

The study reveals a paradox where Roblox's aesthetics are well-received, yet there is substantial doubt about the content's reliability. This dichotomy points to the necessity of developing more stringent content curation and verification processes while leveraging the platform's visual appeal to create an inviting yet dependable educational experience.

The engaging aesthetics of Roblox, appreciated by a significant majority of participants, can transform the learning experience from mundane to captivating, which is particularly beneficial in environments where educational materials are scarce or outdated.

Despite the visual appeal and engagement levels, content reliability concerns cannot be overlooked. This issue might be even more challenging in low-resource settings, where access to verified educational content is critical. Developing and implementing robust content curation and verification mechanisms is essential to ensure that the educational material presented on such platforms is accurate and trustworthy.

Future research should address the content reliability issue on Roblox and further explore how its aesthetic qualities can be harnessed to boost student motivation and engagement in financial education programs. Enhancing content credibility while maintaining the platform's attractive qualities could unlock Roblox's full potential as an educational tool, thus making financial literacy more accessible and engaging for young learners.

6. Considerations

Utilizing Metaverse platforms, such as Roblox, for educational purposes holds transformative potential, particularly in financial education (FinEd). These platforms can effectively simulate real-world market dynamics, budgeting challenges, and investment scenarios, offering experiential learning that traditional educational methods often cannot replicate. However, it is crucial to address the authenticity of the content to avoid the propagation of misinformation that might result in poor financial decision-making.

Our research has successfully leveraged Roblox to create an engaging educational game, showcasing its capability as a versatile learning environment. It blends the reinforcement of financial concepts with enjoyment and interactive technology in a playful and potent manner.

Future research should prioritize resolving content reliability issues to harness the educational power of Roblox and similar platforms fully. This can be achieved through partnerships with financial experts to develop and endorse educational content and introduce user review systems, badges, or certifications to identify trustworthy modules. Furthermore, investigations into refining the game's engaging aspects to boost motivation and the long-term retention of financial knowledge are warranted.

Overcoming these challenges will unlock the Metaverse's true potential in education, especially for enhancing financial literacy. These platforms' immersive and interactive nature can demystify financial concepts for young learners, potentially cultivating a generation with sophisticated financial understanding. In resource-limited contexts, such educational tools could be revolutionary, providing equitable access to essential financial skills training that impacts personal and economic welfare.

The research subjects' financial knowledge was assessed using a pre-test and post-test methodology. The pre-test, administered before the study, gauged initial FinEd knowledge levels. Conversely, the post-test evaluated learning gains post-intervention, utilizing the same test to ensure consistency in measuring core FinEd principles and interaction with the Metaverse.

This testing strategy effectively identifies advancements in user engagement post-exposure to the educational intervention. It offers critical insights for refining system design and educational content, ensuring alignment with user capabilities and

learning requirements.

In summary, the representation of financial behavior within game environments like Roblox is promising for developing strategic financial thinking among students. However, it is essential to integrate these platforms into educational strategies with a commitment to delivering practical, accurate, and valuable financial knowledge. The transformative potential of Metaverse platforms in education must be carefully nurtured to enhance students' financial astuteness and decision-making skills.

Author contributions: Conceptualization, RMV and EFD; methodology, APdS and EFD; software, RMV; investigation, RMV; resources, RMV; data curation, RMV; writing—original draft preparation, RMV; writing—review and editing, RMV and EFD; visualization, EFD; supervision, EFD. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

References

1. Fitrianto I, Hidayat AM. Critical Reasoning Skills: Designing an Education Curriculum Relevant to Social and Economic Needs. International Journal of Post Axial: Futuristic Teaching and Learning. 2024; 2(4): 245–258.
2. Cordeiro NJN, Costa MGV, da Silva MN. Financial education in Brazil: A panoramic perspective. (Portuguese). Ensino da Matemática em Debate. 2018; 5(1): 69–84.
3. Maestri A, Menoncini L. Critical Mathematical Education in Elementary School I: Financial Education Project (Portuguese). Educação Matemática Sem Fronteiras: Pesquisas em Educação Matemática. 2021; 3(1): 56–74. doi: 10.36661/2596-318x.2021v3n1.12378
4. Jabor G, Junior TP, Stanzani LML, Maemura MMD. Digital banks: A study on the relationship between financial education and digital behavior (Portuguese). International Journal of Scientific Management and Tourism. 2024; 10(3): e928. doi: 10.55905/ijsmtv10n3-022
5. de Pinho Coutinho L, Pereira WD, Machado CC. The role-playing game as a pedagogical strategy to work on financial education in basic education. (Portuguese). Anais do III Encontro de Ludicidade e Educação Matemátic. 2021; 1(1).
6. Chattopadhyay S. Education and economics: Disciplinary evolution and policy discourse. Oxford University Press; 2012.
7. Thaler RH, Sunstein CR. Nudge: Improving Decisions About Health, Wealth and Happiness. Penguin Books; 2022.
8. Corsini L, Giannelli GC. Economics education and financial literacy acquisition: Evidence from a field experiment. Journal of Behavioral and Experimental Finance. 2021; 32.
9. Leandro JC, Botelho D. Consumer over-indebtedness: A review and future research agenda. Journal of Business Research. 2020; 145: 535–551.
10. Villa L, da Silva JT, Darroz LM. Financial education in high school: A proposal based on the theory of meaningful learning (Portuguese). Acta Scientiae. 2018; 1(20): 56–76.
11. Neto ACB, das Flores Victer E. Financial education, the inclusion tool in the education of young people and adults to build a secure future: A literature review (Portuguese). Revista Ibero-Americana de Humanidades, Ciências e Educação. 2023; 9: 1236–1247. doi: 10.51891/rease.v9i2.8619
12. Marim V, Silva MG. Financial education: Approach in mathematics textbooks for high school (Portuguese). Educação Matemática Debate. 2020; 4: e20200. doi: 10.24116/emd.e202005
13. Sachs L, Gereti LCV, Ferraiol TF, et al. A critique of financial education in mathematics education. Bolema-Mathematics Education Bulletin. 2023; 37(76): 449–478. doi: 10.1590/1980-4415v37n76a05
14. Boff DS, Zulianelo I. Financial education at school: An insertion into everyday life (Portuguese). Revistade Educação, Ciênciase Matemática. 2022; 12(1): 1–16.
15. Atkinson A. Promoting Financial Inclusion through Financial Education: OECD/INFE Evidence, Policies and Practice Flore-Anne Messy. OECD Working Papers on Finance, Insurance and Private Pensions. 2013; 1: 1–55.

16. Leite GG, Freitas IB, de Castro Bertagnolli S, de Moraes MAC. Our Money: A Serious Game for Introduction to Financial Education (Portuguese). TEAR - Revista de Educação, Ciências e Tecnologias. 2020; 1(9): 1–18.
17. Cunha MP. The financial market comes to the classroom: Financial education as a public policy in Brazil (Portuguese). Educacao e Sociedade. 2020; 41. doi: 10.1590/ES.218463
18. Kistemann MA, Coutinho CQeS, Figueiredo AdC. Scenarios and challenges of financial education with the national common curriculum base (bncc): Teacher, textbook and training (Portuguese). Revista de Educação Matemática e Tecnológica Iberoamericana. 2020; 11(1): 1–26. doi: 10.36397/emteia.v11i1.243981
19. Souza JR. Use of gamification in teaching financial education in Brazil (Portuguese). Revista EaD Tecnologias Digitais na Educação. 2022; 10(1): 33–41.
20. Nicolini G, Cude BJ. The Routledge handbook of financial literacy. Routledge; 2022.
21. de Sousa JF, Pinheiro JML. Elderly people from the perspective of mathematics education (Portuguese). Revista Paranaense de Educação Matemática. 2022; 11(26): 402–421. doi: 10.33871/22385800.2022.11.26.402-421
22. Campos MB, da Silva AM. The production of meanings by elementary school students for financial education tasks (Portuguese). REVISTA DO PROGRAMA DE PÓS-GRADUAÇÃO EM EDUCAÇÃO MATEMÁTICA DA UNIVERSIDADE FEDERAL DE MATO GROSSO DO SUL (UFMS). 2014; 7(14): 283–299.
23. Rebello AP, Filho JBR. Financial education: A pedagogical proposal for polytechnic high school students (Portuguese). HOLOS. 2015; 6(1): 308–314. doi: 10.15628/holos.2015.3645
24. Scolari LC, Grando NI. Financial education: A proposal developed in elementary education (Portuguese). Revista de Educação Matemática Pesquisa. 2016; 2(18): 671–695.
25. Dias CR, De Assis Olgin C. Teaching activities using jclic software in financial education in elementary school (Portuguese). In: Proceedings of the VII CONGRESSO INTERNACIONAL DE ENSINO DA MATEMÁTICA; 4–7 October 2017; Canoas, Brazil.
26. Ramon R, Cappelin A, Fuzzo RA, Boscarioli C. Online teacher training in financial education: A proposal for knowledge and practices (Portuguese). Revista Brasileira de Educação em Ciências e Educação Matemática. 2019; 3(2): 290–316. doi: 10.33238/ReBECEM.2019.v.3.n.2.22611
27. Cruz EP, Barbosa YOF, da Costa e Silva F. Financial mathematics and board games: A low-cost teaching experience (Portuguese). Revista Ciências & Ideias. 2021; 12(4): 1158–176. doi: 10.22047/2176-1477/2021.v12i4.1566
28. Spanevello B, Luís J, Aymone F. Virtual design: Three-dimensional virtual environment as an instrument for financial education of young Brazilians and adults (Portuguese). Revista Diálogo com a Economia Criativa. 2022. doi: 10.22398/2525-2828.72141-64
29. Soares VC, de Oliveira D. Digital games in financial education: An intermediation between the economic world and the digital world (Portuguese). Revista Ibero-Americana de Humanidades, Ciências e Educação. 2023; 9(6): 1478–1495. doi: 10.51891/rease.v9i6.10370
30. Viana BB, Pezarico G. Mapping and analysis of financial education initiatives in Brazil: Overview, profiles and challenges (Portuguese). In: Proceedings of the XXVI Seminários em Administração (SemeAd 2023); 7–10 November 2023; Sao Paulo, Brazil. pp. 1–15.
31. Santos BSC, De Carvalho Damasceno MF, Rodrigues JG. Personal finance and debt: An analysis of financial education and its implications in the Itaim-Pi Valley (Portuguese). Revista Interdisciplinar Cadernos Cajuína. 2024; 1(9).
32. Tibúrcio F, Moreira WL, Schmitt R, et al. The future of digital lies in connecting with the real: Metaverse and its social and technological implications (Portuguese). In: Anais do III Workshop sobre as Implicações da Computação na Sociedade. Sociedade Brasileira de Computação; 2022. pp. 1–9.
33. Tori R. Metaverses in education: Concepts and possibilities (Portuguese). Video Journal of Social and Human Research. 2023; 2(1). doi: 10.18817/vjsh.v2i1.25
34. Cho Y, Woo J, Song I, Choi S. Building Metaverse for Education of Virtually Unified Korean Peninsula using Roblox. Korean Journal of Computational Design and Engineering. 2023; 28(3). doi: 10.7315/cde.2023.302
35. Ho W, Lee D. Enhancing engineering education in the roblox metaverse: Utilizing chatgpt for game development for electrical machine course. International Journal on Advanced Science, Engineering and Information Technology. 2023; 13(3). doi: 10.18517/ijaseit.13.3.18458
36. Damasceno EF, Fernandes LB, Da Silva AP, Moreira ST. An evaluation of immersive laboratory in microbiology teachings. Creative Education. 2024; 15(8): 1718–1732.
37. Vieira EE, de Medeiros FPA. State of the art on education in immersive metaverse environments (Portuguese). Revista Brasileira de Informática na Educação. 2023; 31: 1248–1269. doi: 10.5753/rbie.2023.3522
38. Wiederhold BK. Ready (or not) player one: Initial musings on the metaverse. Cyberpsychology, Behavior, and Social

Networking. 2022; 25(1): 1–2. doi: 10.1089/cyber.2021.29234.editorial
39. Meier C, Saorín JL, de León AB, Cobos AG. Using the roblox video game engine for creating virtual tours and learning about the sculptural heritage. International Journal of Emerging Technologies in Learning. 2020; 15(20): 268–280. doi: 10.3991/ijet.v15i20.16535
40. Tong DH, Uyen BP, Ngan LK. The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. Heliyon. 2022; 8(12).
41. Petri G, Wangenheim CGV, Borgatto AF. Meega+: A model for the evaluation of educational games for teaching computing (Portuguese). Revista Brasileira de Informática na Educação. 2019; 27(3): 52–81. doi: 10.5753/rbie.2019.27.03.52
42. Vilhunen E, Turkkila M, Lavonen J, et al. Clarifying the relation between epistemic emotions and learning by using experience sampling method and pre-posttest design. Frontiers in Education. 2022; 7. doi: 10.3389/feduc.2022.826852