Jurnal Pendidikan Ekonomi
DOI 10.17977/UM014v19i1p083

Research article

Development of Website-Based Interactive Learning Media on Financial Institutions to Address the Challenges of Artificial Intelligence

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Abstract
This study addresses low student participation in self-directed economics learning and the suboptimal use of interactive learning media in schools. As an alternative solution in the artificial intelligence era, this research focuses on developing and testing the feasibility of Edu-Finance media on financial institutions subject matter. The development stages follow the structured ADDIE model, comprising analysis, design, development, implementation, and evaluation. The study was conducted in the 10th-grade at SMAN 7 Malang by comparing an experimental group and a control group. Based on the results, Edu-Finance achieved a validity score of 89.9% (highly valid) and a practicality score of 90.2% (highly practical). The media's effectiveness was demonstrated by the experimental class's N-Gain score of 79.3% (effective), outperforming the control class at 45% (less effective). These findings were reinforced by an Independent Samples t-Test (sig. 0.000 < 0.05). Thus, Edu-Finance is valid, practical, and effective in optimizing learning outcomes and self-directed learning.

Keywords: interactive educational media, website, edu-finance, self-directed learning, learning outcomes

INTRODUCTION

The technological transformation marked by the emergence of industry 4.0 and the society 5.0 paradigm has brought significant changes to the global order of life (Kyriakopoulos, 2024). The development of artificial intelligence (AI) technology has profoundly influenced the way humans work and interact (Lindgren, 2025). The implementation of AI opens a wide range of opportunities, including enhanced efficiency in learning processes, the provision of adaptive instructional materials, and administrative support that strengthens the operational performance of educational institutions (Kuzior et al., 2023). Amid this massive wave of digital transformation, financial literacy has emerged as a critical competency that must be mastered by the younger generation, particularly students at the senior secondary education level (Koskelainen et al., 2023). A solid understanding of financial institutions constitutes an essential foundation in preparing a financially intelligent generation capable of adapting to the evolving of the global economic system.

At present, the implementation of economics learning in senior secondary schools continues to face numerous challenges. Findings from the National Survey on Financial

Received: 06 January 2026; Revised: 28 February 2026; Accepted: 03 March 2026
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Literacy and Inclusion, conducted by the Financial Services Authority (OJK, 2024), reveal that although the national financial literacy index of the Indonesian population has reached 65.43%, the level of financial literacy among adolescents and senior secondary school students remains below optimal. Some studies (Alshebami & Aldhyani, 2022; Hamidah et al. (2023) affirmed that the low level of financial literacy among adolescents is attributable to a lack of access to contextually relevant financial education. This condition reflects the fact that the process of delivering financial content instruction in schools has yet to operate optimally, with one of the contributing factors being the still-limited utilization of innovative and contextually grounded learning media capable of stimulating students' interest and motivation to learn.

Conventional instruction, which characterized by lecture-based methods and the use of printed textbooks, is considered insufficiently adaptive to the learning styles of Generation Z students who have grown up in an environment shaped by digital technology (Cain et al., 2022). The misalignment between traditional pedagogical approaches and the learning characteristics of contemporary students has the potential to contribute to diminished conceptual understanding, with respect to financial institution subject matter, which is inherently abstract and complex in nature (Assem et al., 2023). Yadav (2024) asserted that the utilization of digitally based instructional media in the Society 5.0 era has been demonstrated to enhance student learning autonomy, although its implementation in actual educational practice has yet to reach an optimal level. Furthermore, Wahyunigtyas and Triwahyuni (2025) established that a website-based learning model is significantly more effective in cultivating critical thinking skills among senior secondary school students compared to conventional instructional approaches.

These conditions are consistent with empirical findings obtained through a preliminary observation conducted by the researcher at SMAN 7 Malang. The results of the preliminary observation indicate that the utilization of interactive learning media at the aforementioned institution remains considerably limited in its application. Economics instruction for Grade X students tends to rely on one-directional presentation media, such as PowerPoint slideshows, which consequently restricts the active engagement of students in the learning process. Such circumstances have resulted in a notably low level of student engagement in the instructional process, accompanied by suboptimal development of independent learning capacity. The majority of students continue to exhibit a tendency to depend on teacher-delivered explanations and have yet to develop familiarity with leveraging technology as a medium for self-directed learning, in relation to financial institution subject matter, which is abstract and contextual in nature. This finding is corroborated by Yadav (2024), who asserted that well-designed digital learning environments hold significant potential for enhancing independent learning among secondary school students, with the quality of media design serving as a decisive determinant of its overall effectiveness.

The aforementioned challenges are further compounded by a policy issued by the East Java Provincial Government through the Regional Education Office, enacted in response to a Joint Decree involving four ministries namely the Ministry of Higher Education, Science, and; the Ministry of Communication and Digital Affairs; the Ministry of Population and Family Development; and the Ministry of Women's Empowerment and Child Protection which imposes restrictions on the use of personal electronic devices within school environments (Izzatun & Andik, 2026). This policy is intended to minimize the adverse effects of unguided technology use; however, it simultaneously presents a distinct challenge to efforts aimed at integrating technology into instructional practice.

These circumstances necessitate the development of innovative instructional media that remains contextually relevant, purposefully structured, and of high educational value. Consequently, there is a pressing need for media that is not merely technology-based, but also thoughtfully and deliberately designed to ensure optimal usability within such constraints specifically, media whose implementation is structurally embedded within the context of formal learning under the direct supervision and guidance of a qualified educator.

On the other hand, the advancement of AI presents a dual impact on the Indonesian educational landscape. The integration of AI into senior secondary school learning systems faces several substantive challenges, including disparities in digital infrastructure and digital readiness across educational institutions (Du et al., 2024) insufficient AI literacy and pedagogical competencies among educators, particularly in addressing diverse educational and socio-cultural contexts (Tagare et al., 2025; Sperling et al., 2024); and inadequate institutional governance to address data privacy, algorithmic transparency, and the ethical use of AI in educational settings (Hakimi et al., 2021). Furthermore, Sihaloho and Napitupulu (2024) revealed that although AI holds considerable transformative potential for education in Indonesia, its implementation remains uneven and continues to require structured pedagogical guidance. Accordingly, the development of instructional media that does not merely follow technological trends, but is also purposefully oriented toward equipping students to navigate the challenges of the artificial intelligence era, constitutes an imperative that can no longer be deferred.

A body of prior research has substantiated the effectiveness of website-based instructional media in economics education. Bashith et al. (2025) demonstrated that integrating Google Sites with problem-based learning improved students' learning motivation and academic achievement in economics. Similarly, Aprilya and Mariatun (2024) established that Google Sites-based multimedia was effective in strengthening students' conceptual understanding of economics. Evidence from Wahyunigtyas and Triwahyuni (2025) further indicates that Google Sites-based learning media can improve critical thinking skills among senior secondary school students. In addition, Rohmah and Sakti (2022) developed an interactive electronic module addressing financial services institutions for Grade X Social Sciences students at the senior secondary level, finding that the product was suitable for instructional use and supported students' understanding of financial services institution concepts. Nevertheless, none of these studies has specifically undertaken the development of website-based instructional media that integrates financial institution content with substantive responses to the challenges posed by artificial intelligence, digital inequality, and sustainability within a single unified platform. This gap in the existing literature provides the basis for the present study and establishes its research relevance and contribution.

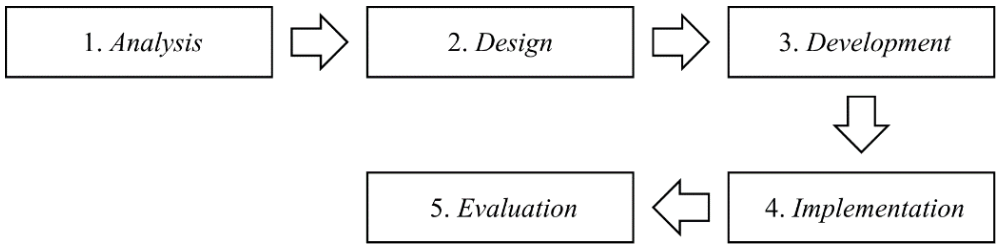
Edu-Finance is designed as an interactive website-based instructional medium that integrates financial institution subject matter with a range of technology-driven features, including interactive quizzes, concept maps, structured learning materials, and summative evaluation components. With a user-friendly interface design and an active learning approach, Edu-Finance is anticipated to deliver an engaging and educationally stimulating learning experience for Grade X senior secondary school students. Beyond its function as a conventional learning medium, Edu-Finance is conceived as a substantive response to three principal challenges of the twenty-first century, including the disruptive advancement of artificial intelligence, inequity in educational access, and the imperative of sustainability.

Based on the foregoing discussion, a significant gap exists between the need for innovative, technology-based instructional media in the domain of financial institution subject matter and the availability of currently existing learning media, as reflected in the empirical conditions. The limited availability of interactive media, the predominance of unidirectional instructional delivery, the low level of student learning autonomy, and the policy challenges surrounding the restriction of personal electronic devices collectively reinforce the urgency of developing a precisely targeted instructional solution. On this basis, the present study is designed to produce an interactive website-based instructional medium entitled Edu-Finance, addressing financial institution subject matter for Grade X senior secondary school students, developed through the ADDIE instructional design model, as a concrete response to the challenges posed by artificial intelligence advancement, inequity in educational access, and the imperative of sustainability in the digital era.

METHOD

The methodological approach applied in this study is Research and Development (R&D), a research approach designed to produce a specific learning product while simultaneously testing its effectiveness (Sugiyono, 2019). R&D research was chosen because the primary objective of this study is not merely to test hypotheses or describe phenomena, but to produce educational media that is valid, appropriate, and effective for use in real-world educational contexts in schools. The media development model applied in this study is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model was chosen because it provides a structured framework with clear, well-defined, and interrelated stages (Branch, 2009). The stages of the Edu-Finance website development are provided in Figure 1.

Figure 1
The Stages of the ADDIE Model



The development of Edu-Finance followed the five stages of the ADDIE model in sequence. During the Analysis stage, the researchers conducted a needs analysis by observing and interviewing 10th-grade economics teachers at SMAN 7 Malang, analyzing student characteristics, and analyzing the scope of core competencies in the financial institution's curriculum. The Design phase includes the development of a concept map for the content, the design of storyboards and the website's navigation flow, and the development of validation tools and learning outcome assessments. During the Development phase, the Edu-Finance product is built by integrating interactive content features, a digital concept map, quizzes with automatic feedback, and a final assessment; it is then validated by subject matter experts and media experts before being pilot-tested. The Implementation phase was conducted in two 10th-grade classes at SMAN 7 Malang:

Class X10, which served as the experimental class using Edu-Finance, and Class X7, which served as the control class and continued to use conventional learning materials. The entire process concluded with the Evaluation phase, which was conducted formatively at each stage of development and summative by comparing the learning outcomes of the two classes.

This study focuses on three aspects of product quality, namely: (1) validity, which measures the suitability of the media in terms of both content and presentation; (2) practicality, which measures the extent to which the media is easy and convenient for teachers and students to use; and (3) effectiveness, which measures the impact of media use on students' learning outcomes.

This study relies on quantitative data derived from expert validation instrument scores, a usability questionnaire, and students' pre-test and post-test scores. Data collection methods included: (1) validation by subject matter experts and multimedia experts using a 1–5 Likert scale to assess the appropriateness of the content and the visual design of the media; (2) a questionnaire on the suitability of use distributed to students and educators after the implementation of the media; and (3) an assessment of learning achievement in the form of pre-tests and post-tests in both class groups. The data analysis process included testing for media and content validity, testing the suitability of the product, measuring improvements in learning outcomes using the N-Gain test, testing basic assumptions (normality and homogeneity), and conducting an independent samples t-test.

RESULT

This research and development project successfully created a website-based interactive learning platform called Edu-Finance, designed to support the teaching of financial institutions to 10th-grade high school students. Unlike conventional learning media, Edu-Finance was developed as a solution to the low level of student engagement in economics education and as a response to three 21st-century challenges: the development of artificial intelligence, disparities in access to education, and the urgency of sustainability. This platform consists of eight main sections, including: an introduction, developer profile, user guide, learning objectives, concept map, learning materials, and practice questions. All sections of the Edu-Finance website are integrated so that students can learn independently, purposefully, and interactively from understanding basic concepts to assessing their mastery of financial institutions-related material.

Validity Test

Before being implemented in classroom instruction, the Edu-Finance learning material was first assessed for suitability through a validity test. This process involved two evaluators: one economics teacher as a subject matter expert and one computer science teacher as a media expert, who provided assessments using a 1–5 Likert-scale validation sheet. Validity itself reflects the extent to which an instrument can accurately assess the aspects it is intended to measure with precision and care (Spoto et al., 2025). In the context of instructional material development, the validity test aims to provide a comprehensive overview of the product's quality while gathering feedback for improvements before the product is used in actual classroom instruction. Through this stage, the researcher can ensure that the developed instructional material meets the

necessary theoretical and technical standards required to support the teaching and learning process. The assessment results from both validators are presented in Table 1.

Table 1
Validation test result

No	Validator	Score	Score Max	Percentage	Criteria
1	Subject Matter Expert	57	65	87.6%	Very Valid
2	Media Expert	77	85	90.6%	Very Valid
	Average			**89.1%**	**Very Valid**

Based on Table 1, the Edu-Finance media achieves a validation percentage of 87.6% from the content experts and 90.6% from the media experts, and the overall average reaches 89.1% which falls into the very valid category. This achievement indicates that the financial institution material implemented in the media aligns with basic abilities, conceptually accurate, and relevant for eleventh-grade high school students. From the media side, the interface design, ease of navigation, and completeness of interactive features are considered adequate as a website-based learning media. The high validation percentage reflects the accuracy of instruments in evaluating variables that should be targeted. Thus, Edu-Finance is declared valid and suitable to be continued to the field-testing stage.

Figure 2
Edu-finance website design



Interactive Edu-Finance learning media based on website can be used as a learning resource for students as well as a tutoring medium for teachers in explaining financial institution materials in a more interactive and functional way. This media can be accessed online via https://bit.ly/EduFinance_KelasX. The development of Edu-Finance is not only oriented toward improving the quality of learning but also designed as a response to three 21st-century education challenges. First, in facing the development of artificial intelligence, Edu-Finance leverages technology in a targeted way within the formal learning context so that students are not merely passive technology users but can learn actively, critically, and meaningfully. Second, as a website-based medium that can be accessed anytime and anywhere, Edu-Finance has the potential to bridge gaps in access to quality education across Indonesian schools. Third, the use of this digital media directly reduces dependence on printed materials, which is a tangible contribution to

environmental sustainability. as mandated in Sustainable Development Goals (SDGs), especially target 4 on quality education.

Practicality Test

Feasibility testing is conducted to identify the level of ease, attractiveness, and usefulness of Edu-Finance media when used in actual learning processes. The practicality assessment was obtained from two sources, namely students and the Economics subject teachers at SMAN 7 Malang. The measurement tool used is a Likert-scale 1–5 survey administered after students and teachers apply the Edu-Finance media into learning activities. The data on practicality assessments from both respondents are presented in Table 2.

Table 2
Result of the edu-finance usability test

No	Respondent	Score	Score Max	Percentage	Criteria
1	Students	2.054	2.250	91.3%	Highly Feasible
2	Teacher	58	65	89.2%	Highly Feasible
		Average		**90.2%**	**Highly Feasible**

Based on Table 2, the overall ease of edu-finance media reaches 90.2% with the category highly feasible for use based on Riduwan (2019) criteria. This indicates that the Edu-Finance media is easy for students to access and operate independently, easy to integrate into learning activities by teachers, and able to encourage active student engagement in understanding financial institution materials.

Effectiveness Test

N-Gain Test

Results of the n-gain test (Table 3) calculations for the experimental group and the control group indicate that the average n-gain score in the experimental class (using Edu-Finance) reaches 79.2858 or 79.3%, which falls into the effective category (range >76%). Conversely, the average n-gain score in the control class (using conventional approach) is only 44.9505 or 45%, which falls into the less effective category (range minimum 40% to maximum 55%).

Table 3
Average n-gain test result

No	Class	Average	Percentage	Criteria
1	Experimental	0.7929	79.3%	Effective
2	Control	0.4495	45%	Less Effective

Thus, it can be concluded that the use of Edu-Finance as an interactive website-based media is effective in improving learning achievement in the economics subject material on financial institution topics for students. Therefore, the use of conventional methods shows fewer effective results in improving learning outcomes in economics lessons on financial institutions material for students.

Normality Test

In this study, the normality test was performed using the Shapiro-Wilk method via SPSS software, considering the class sample size reaching 30 students ($n \leq 50$). This

approach was chosen because the Shapiro-Wilk test is more precise and accurate than Kolmogorov-Smirnov for small to moderate samples. The testing focused on student learning outcome data, including pre-test and post-test scores from the experimental class and the control class. The results of the normality test are summarized in Table 4.

Table 4
Result of normality test

No		Class	Shapiro-Wilk		
			Statistic	df	Sig.
1	Result	Pretest Experimental	0.956	30	0.247
2		Posttest Experimental	0.952	30	0.196
3		Pretest Control	0.958	30	0.273
4		Posttest Control	0.932	30	0.057

Shapiro-Wilk normality test findings indicate that the pre-test and post-test scores for the experimental and control groups achieved significance values respectively as follows: pre-test for the experimental group (0.247), post-test for the experimental group (0.196), pre-test for the control group (0.273), and post-test for the control group (0.057) all exceeding the 0.05 threshold. Thus, the pre-test and post-test data from both groups are normally distributed, thereby meeting the prerequisites to proceed to homogeneity testing.

Homogeneity Test

After verifying that the data follow a normal distribution, the next step involves testing homogeneity to determine whether the variance of learning outcomes between the experimental and control classes is homogeneous. The homogeneity test is conducted via Levene's Test with SPSS software support. The results are presented in Table 5.

Table 5
Result of homogeneity test

			Levene's Statistic	df1	df2	Sig.
1	Result	Based on Mean	3.298	3	116	0.053
2		Based on Median	2.884	3	116	0.069
3		Based on Median and with adjusted df	2.884	3	104.796	0.058
4		Based on trimmed mean	3.250	3	116	0.061

Based on Table 5, the homogeneity test using Levene's Test (based on the mean) yields a significance value of 0.053, which is greater than 0.05. Therefore, the variance of learning achievement data between the experimental group and the group assumption checked to be homogeneous, thus meeting the prerequisites to proceed to the independent samples t-test.

Independent Sample t Test

The independent samples t-test was conducted to examine significant differences in learning outcomes between the experimental group (using Edu-Finance media) and the control group (implementing conventional teaching approaches). The findings from the Independent Sample t-Test are presented in Table 6.

Table 6
Result of independent sample t-test

	Levene's Test		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean	Std. Error	95% CI Lower	95% CI Upper
Equal variances assumed	2.731	0.104	6.941	58	0.000	17.500	2.521	12.453	22.547
Equal variances not assumed			6.941	50.463	0.000	17.500	2.521	12.437	22.563

As shown in Table 5, the results of the independent sample t-test on the row "Equal "Equal Variances Assumed" indicates a Levene's value of 2,731 with a significance of 0,104 > 0,05, confirming that the data from both classes are homogeneous. It also produces a t value of 6,941 and a significance value (2-tailed) of 0,000. Considering that the significance value is less than 0,05, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted, indicating a significant difference in learning achievement between students in the experimental group and the control group. The average achievement of the experimental group is higher than that of the control group, with the mean difference reaching 17,500 points. 17,500 points. Thus, it can be concluded that the implementation of the website-based interactive learning media Edu-Finance is significantly more effective in improving students' learning achievement on the topic of financial institutions compared to conventional learning.

DISCUSSION

The findings demonstrate that Edu-Finance meets the criteria for a valid, practical, and effective learning medium. The validation score of 89.1% indicates that the platform is highly suitable for delivering financial institution-related materials, suggesting that its content and instructional design are conceptually appropriate. Similarly, the practicality score of 90.2% reflects its ease of use for both independent student learning and teacher-led classroom instruction. These results suggest that Edu-Finance not only meets the technical requirements of an educational product but also offers an accessible learning environment that supports the delivery of financial education. The combination of high validity and practicality scores provides an important foundation for its implementation in classroom learning, as the quality of instructional media depends not only on the accuracy, relevance, and instructional alignment of its content (van Haastrecht et al., 2024), but also on its usability, accessibility, and capacity to facilitate teaching and learning activities (Utami et al., 2025).

The effectiveness of Edu-Finance is further supported by the Independent Samples t-test, which reveals a statistically significant difference in learning achievement between the experimental and control classes. This finding is reinforced by the N-Gain analysis, in which the experimental class demonstrates a substantially greater improvement than the control class, which achieves an N-Gain score of only 45%, categorized as less effective. This difference suggests that integrating interactive web-based features into financial education can enhance students' understanding of financial institution-related concepts. One possible explanation is that the interactive features help students engage more actively with learning materials, making concepts that may otherwise be abstract more accessible and easier to understand. This finding is relevant

given the continuing challenges in improving financial literacy among adolescents (OJK, 2024; Hamidah et al., 2023). It also supports previous studies by Sari and Hakim (2025); Mustofa et al. (2022), which demonstrate the effectiveness of web-based learning media in improving students' understanding of economic concepts. However, the present findings extend this evidence by demonstrating the potential application of interactive web-based media specifically in financial education.

The greater improvement observed in the experimental class also be associated with the learning flexibility offered by Edu-Finance. Unlike conventional learning materials that primarily rely on textual explanations, web-based interactive media allow students to access information and engage with learning content through a more dynamic learning environment (Wong & Hughes, 2023). This approach can drive students to take a more active role in constructing their understanding of financial concepts. In the context of financial education, such an approach relevant because students need more than conceptual knowledge; they also need to understand how financial institutions operate and how their services relate to everyday economic decisions (Klapper & Lusardi, 2020). This provides a potential explanation for the better learning achievement observed in the experimental class compared with students who receive conventional instruction.

Furthermore, these findings highlight the importance of integrating digital learning media into financial education at the secondary school level. Improving students' understanding of financial institutions represents an important step towards developing financial awareness and informed economic decision-making. However, the effectiveness of digital learning media does not depend solely on the availability of technological features but also on how teachers integrate these resources into instructional activities. Teacher guidance, appropriate learning strategies, and students' active engagement remain important conditions for maximizing the educational value of Edu-Finance. Thus, the platform should be understood not as a replacement for teachers or conventional instructional approaches, but as a complementary medium that enriches the learning process. This perspective also reinforces the importance of aligning digital innovation with pedagogical objectives to ensure that technology contributes meaningfully to students' learning outcomes.

The implementation of Edu-Finance has further implications for educational practice and policy in the digital era. From a practical perspective, the platform provides an alternative approach to integrating digital technology into classroom instruction, particularly in the context of the East Java Provincial Government's policy restricting gadget use among students. Its implementation under teachers' direct supervision offers a structured approach to using digital devices for educational purposes rather than unrestricted access (Izzatun & Andik, 2026). Furthermore, the platform encourages Generation Z students to engage with technology as an active learning resource, supporting the development of more meaningful digital learning experiences. At the institutional level, Edu-Finance offers an opportunity for schools to expand access to interactive learning materials and strengthen the integration of financial education into classroom activities. Its web-based format also provides an alternative to conventional printed materials, although its broader contribution to educational equity and environmental sustainability will depend on accessibility, infrastructure, and implementation conditions across schools. In this regard, Edu-Finance supports the broader objective of improving the quality of education in line with Sustainable Development Goal 4 (SDG-4).

CONCLUSION

Based on the research and development process, Edu-Finance, a web-based interactive learning medium for financial institutions, has demonstrated its validity, practicality, and effectiveness as an educational product. The platform provides relevant content and an appropriate visual design while offering an accessible and engaging learning experience for both students and teachers. Furthermore, its implementation demonstrates better learning outcomes than conventional instructional approaches, indicating its potential to enhance students' understanding of financial institution-related concepts. Edu-Finance represents a promising digital learning innovation for improving the quality of economics instruction and supporting students' independent learning in the era of artificial intelligence. Despite these positive findings, this study has limitations. The implementation of Edu-Finance was conducted within a specific educational context and involved a limited sample, which may restrict the generalizability of the findings to other schools and student populations. Furthermore, the effectiveness assessment focused primarily on immediate learning outcomes rather than long-term knowledge retention and financial behavior. Future research could therefore examine the applicability of Edu-Finance across different educational settings and employ longitudinal designs to assess its sustained impact on students' financial literacy and decision-making competencies. Further development could also incorporate gamification and financial simulations to provide more engaging and practical learning experiences.

Authors Contribution
K. S: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, and Visualization. A. N. Z: Data curation, Investigation, and Writing – original draft. M. A. B. R: Validation, Writing – review & editing, and Project administration

Acknowledgements
Not applicable

Competing interests
The author has declared that there are no conflicts of interest

Data availability
The data were provided upon request to corresponding author (khlmtsdyh@gmail.com)

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