

Enhancing Financial Literacy through Innovative Assessment: Development and Evaluation of the FLIA-hub for Business Students

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Abstract: - This study developed and evaluated FLIA-hub (Financial Literacy Innovative Assessment Hub), a technology-enabled assessment platform for second-year business students. Using a three-phase Design and Development Research process, the study conducted needs analysis, iterative design and development, and a quasi-experimental pretest-posttest evaluation with intervention and control groups (n=60). Results showed that students using FLIA-hub achieved greater financial literacy gains than the control group (+10.25 versus +1.38 points), with significant improvements in engagement, empowerment, satisfaction, confidence, and attitudes toward digital learning. The findings indicate that assessment-centered digital platforms with interactive tasks, real-time feedback, and progress analytics can strengthen financial literacy learning and support students' ability to apply financial knowledge in decision-making.

Key-Words: - Financial literacy, Technology-based assessment, FLIA-hub, Business students, Design and Development Research (DDR), Digital learning, Student engagement, Structural Equation Modeling (SEM).

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1 Introduction

1.1 Background

Financial literacy is a critical day-to-day skill of an individual who must cope with the intricacies of the contemporary economies. It can help one make good financial choices, control their own finances, and have a secure future in finances, [1]. The importance of financial literacy is especially high in the case of university students, who enter the field of financial independence and start to take care of their spending, savings, and investments, [2]. Regardless of its significance, the studies show that a significant portion of students, even those who study business, do not have sufficient financial literacy and money management experience, [3], [4]. Such a lack can cause ill financial decisions and overwhelming debts, which can adversely affect the academic performance and well-being of students.

Conventional methods of financial education, including lectures and learning with textbooks, tend to be ineffective in capturing the students and have a limited ability to test their practical financial skills, [5], [6]. To address it, educators are turning to alternative educational methods, such as digital

learning, gamification, and interactive assessment, more frequently to improve financial literacy education, [7], [8]. Technological use of financial education does not only transform the process of the financial education process into a more interactive one and offers the possibility of a real-time feedback and a personalized learning process, [9].

This research proposes a technology-based, evaluation tool, the Financial Literacy Innovative Assessment Hub (FLIA-hub), which is aimed to overcome these issues and provide financial literacy to business students. The FLIA-hub is a combination of interactive learning, new evaluation methods, and a systematic financial literacy curriculum that enhance the financial content, student engagement, and perceived empowerment. The present research applies Design and Development Research (DDR) research methodology to formulate and test the effectiveness of FLIA-hub systematically in three phases; Needs Analysis, Design and Development, and Implementation and Evaluation phases.

1.2 The Importance of Financial Literacy in Higher Education

Financial literacy is an essential skill that determines the capacity of an individual to make good use of financial resources, future planning, and reaction to financial uncertainty, [1], [3]. Financial literacy is a significant concern when it comes to promoting responsible financial behaviors among the students of the university, including budgeting, saving, and investing, [10]. Nevertheless, a great number of studies show that the level of financial literacy among university students, especially in the developing economies, is disastrously low, [2], [11], [12].

Financial illiteracy may lead to bad financial practices, including overuse of credit, insufficient saving, and mismanagement. Research conducted in [3] and [13] indicates that young adults tend to have difficulties when it comes to comprehending simple financial concepts, such as the interest rates, inflation, and the management of debts. The growing sophistication of financial products and online payment systems adds to these complications, [14]. In light of these facts, financial literacy education should not be based on theoretical learning but should focus on practical and technologically enriched learning experiences that can involve the students and evaluate their practical skills in financial decisions, [15].

1.3 Traditional Financial Literacy Education Limitations

Although there is an attempt to incorporate financial education in university courses, there are various shortcomings of the traditional methods of teaching. Students are not frequently engaged in conventional teaching methods, which could be lectures and textbook reading, [16], [17]. Also, the modes of assessment are mainly based on standardized testing that fails to effectively assess the skills of the students when putting financial concepts into practice.

Some researchers claim that the active learning strategies (such as problem-solving tasks, simulations, and case studies) should be included in the financial education to increase student engagement and retention, [18]. Moreover, it has been reported that the application of technology in the learning process of financial literacy is critical to the enhancement of final outcomes, [8], [19], [20]. Financial education becomes more affordable and efficient with the help of digital learning where personalized instruction, instant feedback, and interactive assessments are possible.

In addition to these pedagogical constraints, conventional financial literacy instruction often suffers from low authenticity and weak alignment between learning outcomes and assessment. When assessment is dominated by decontextualized quizzes or end-of-term written examinations, students may demonstrate short-term recall while remaining unable to transfer concepts (e.g., interest compounding, inflation, debt servicing, and risk-return trade-offs) to everyday financial decisions. This mismatch reduces formative feedback opportunities and can mask misconceptions until late in the course, limiting instructors' ability to scaffold learning effectively, [5], [17].

Furthermore, traditional approaches are less responsive to the diverse prior knowledge and digital habits of contemporary students. Business students frequently engage with digital payment ecosystems and fintech services, yet classroom delivery rarely integrates these realities into practice-oriented tasks. As a result, learners may perceive financial literacy as abstract and disengage, which undermines motivation, persistence, and self-efficacy, [16], [18].

1.4 The part of Technology in Financial Literacy Education

The application of technology in financial education has revolutionized the traditional models of learning a subject because more interactive and personalized learning takes place. Gamified learning platforms, mobile applications, and e-learning platforms have found a wide application to deliver financial education, [21]. According to [22], interactive digital tools help students to become much more engaged and understand financial concepts greatly.

Specifically, assessment-based learning platforms have become the focus of interest as tools of financial education. These platforms will include both formative and summative assessments to determine the financial knowledge and decision-making skills of students. As researchers point out, digital tests offer real-time feedback, which enables students to monitor their progress and enhance their financial decision-making skills, [6], [23].

According to the Technology Acceptance Model (TAM), [24], [25], the perceived usefulness and perceived ease of use are the factors that determine the effectiveness of digital learning tools amongst the students. A properly designed financial literacy site must include user-friendly interfaces, live assessment, and live-action content to have good engagements and retention of knowledge, [19]. With this information in mind, the FLIA-hub was

created to take advantage of digital technologies to improve the financial literacy learning outcomes.

1.5 Research Gaps and Study Objectives

Although a number of studies have been done to emphasize the significance of financial literacy education, very few studies have been made to determine the use of assessment-based learning platforms in financial education among students of universities. The current literature is not always concerned with the assessment of students and the role of assessment tools in influencing the learning outcomes.

In order to fill this gap, the research will be seeking to:

Design and deploy the FLIA-hub as a new learning platform that is based on assessment to teach financial literacy.

Assess the effectiveness of FLIA-hub in enhancing financial literacy knowledge and student engagement and perceived empowerment.

Compare between conventional and innovative methods of assessment to find out the effects of digital assessment on the financial literacy learning outcomes.

To clarify the methodological complexity underlying these objectives, the DDR approach in this study is not a single-step intervention but an iterative design cycle that integrates (i) qualitative needs analysis (faculty interviews and student focus groups) to specify learning problems and user requirements; (ii) evidence-informed design and development of assessment items and interface components aligned to financial literacy frameworks and usability heuristics; and (iii) implementation and evaluation using a quasi-experimental pretest-posttest design with parallel groups, complemented by platform analytics (usage traces) and validated questionnaires capturing engagement, empowerment, satisfaction, confidence, and digital learning attitudes. The analytic workflow combines inferential tests (e.g., paired/independent t-tests and ANOVA where appropriate) with SEM to test the hypothesized mechanism linking engagement-related constructs to financial literacy knowledge. This multi-method, multi-phase structure is necessary to ensure both pedagogical validity (what is assessed) and technological feasibility (how the assessment is experienced) before causal claims are made.

This study utilizes a methodology of Design and Development Research (DDR), and has been done in a structured process comprising of Needs Analysis, Design and Development, and

Implementation and Evaluation. The study results will enlighten on the best practice in designing technology-based financial education programs and advance the general knowledge on financial literacy education.

2 Theoretical Foundations and Conceptual Model

2.1 Constructivist Learning Theory

Constructivist Learning Theory, a theory put forward as the [26] and extended as the [27], posits that learning occurs through constructive engagements by the learner and not passive receipt of information. This approach sees learning as an interactive process that is dynamic in nature and in which the students bring together the new information with their previous experiences through exploration, problem-solving and reflecting. Constructivist theories focus on the student-centered learning environments in which students work on real-world problems, exchange their ideas with peers, and get feedback to improve their knowledge.

Constructivist principles are especially topical in the paradigm of financial literacy. Standard financial education has mostly depended on memorizing of financial concepts, which are not necessarily effective in making financial decisions, [4]. Rather, statistical learning activities, e.g. simulations, case studies and problem solving assignments, enable the students to learn financial concepts in real life contexts, which encourages increased understanding and long term recall, [18].

The design of FLIA-hub is premised on the constructivist concepts, which provide students with experiential learning opportunities to apply their theoretical knowledge in the practical setting and experiment with various financial options and get a real-time feedback on their choices. Through the incorporation of interactive learning tools and self-paced e-learning, FLIA-hub helps students to embrace ownership of their learning and enhance active learning and self-efficacy in financial decision-making.

In addition, constructivist learning also puts great emphasis on scaffold whereby learners are introduced to complex concepts in a systematic fashion. This principle is built into FLIA-hub, which develops its evaluation instruments based on incremental levels of difficulty with the students being able to first grasp simple financial concepts (e.g., budgeting and saving) and eventually move on to more complex issues (e.g., investment and debt

management). This would make the students have a well-developed financial knowledge base, and this would sharpen their thinking capacity to make the sound financial judgment.

2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was first introduced in [24] and subsequently refined in [25] also is the model that explains the adoption and use of new technologies among individuals depending on their beliefs of usefulness and ease of use. The TAM postulates that the engagement of a technological tool by users depends on two factors:

Perceived Usefulness (PU): This is the degree to which an individual feels that the use of a certain technology will improve his performance.

Perceived Ease of Use (PEU): The extent to which an individual has a perception that the usage of the technology is effortless and easy to use.

TAM has been extensively used in learning environments to examine how students adopt learning e-learning platforms, online tests, and online learning tools, [19], [28]. Studies indicate that students see a learning platform as helpful and user-friendly, the more they will be ready to consume the content, and the better their learning results will be [22].

Beyond the original TAM, subsequent extensions (e.g., TAM2 and related acceptance models) emphasize that perceptions of usefulness and ease of use shape attitudes and intentions through both instrumental beliefs (performance benefits) and experience-related beliefs (effort, clarity, self-efficacy). In higher-education settings, these perceptions are also intertwined with students' affective responses (e.g., satisfaction), behavioral engagement (active participation), and willingness to continue using digital learning resources, [19], [25], [28]. In line with these models, the present study treats attitudes toward digital learning as the proximal acceptance outcome, while engagement and satisfaction are modeled as downstream learning-process outcomes that can plausibly mediate knowledge acquisition in technology-supported assessment environments.

Operationally, perceived usefulness in FLIA-hub is reflected in students' judgments that the platform improves their ability to practice financial decision-making through scenario-based assessment, immediate feedback, and progress analytics. Perceived ease of use is reflected in the clarity of navigation, transparency of instructions, and low friction in completing assessments. These acceptance beliefs are captured through the FLIA-hub Effectiveness Questionnaire (FLEQ) alongside

engagement-related indicators, allowing the study to examine not only whether FLIA-hub 'works', but also why students are willing to engage with it. Related acceptance research in sustainability-oriented digital contexts similarly shows that perceived usefulness and ease of use are robust determinants of users' attitudes and engagement with technology-enabled practices, [29], [30].

FLIA-hub is compatible with TAM in that it has a convenient digital interface, interactive financial literacy, and real-time feedback. FLIA-hub will be designed with: to be perceived as highly useful.

It takes a form of real world applications of financial literacy in which the students can observe the real world benefits of learning financial management skills.

- Motivation and engagement improvement (through gamified elements, e.g., progress tracking and interactive quizzes).

- Instant performance metrics, which will give students an overview of their strengths and weaknesses.

Also, the ease of use is considered to be a core element in the design of FLIA-hub. Through user-friendly navigation, explicit directions, and dynamic learning settings, the platform lowers the cognitive load and improves the students' capacity to concentrate on learning about financial concepts without technological challenges. The studies have shown that students who can use educational platforms that are easy to operate tend to have positive attitudes towards learning and continue with their activities on the subject matter, [24], [25].

To conclude, TAM offers a solid base of the development of technology-based financial literacy education as the factor that would stimulate student engagement and learning outcomes. By making sure that it is perceived to be useful and easy to use, FLIA-hub will be in a position to improve the financial literacy knowledge, engagement, and self-confidence of students in making financial decisions.

2.3 Conclusion: A Unified Framework for FLIA-hub

Although Constructivist Learning Theory and TAM present valuable information about student learning and involvement, the ultimate theoretical approach to be used in this particular research is the CIPP (Context, Input, Process, Product) Evaluation Model. The CIPP model offers a multifaceted technique of planning, executing, and measuring the efficacy of educational interventions, which is why it is especially pertinent to assess the effect of FLIA-hub.

The CIPP model is made of four main elements:

Context Evaluation- Determining the financial literacy requirements of the students.

Input Evaluation – Conceptualizing FLIA-hub to be an evidence-based instructional approach (e.g. constructivist learning, technology-enhanced assessment).

Process Evaluation -Observing the process of student interaction with FLIA-hub to evaluate student usage and satisfaction.

Product Evaluation- Evaluation of increase in financial literacy, engagement and self efficacy.

The combination of Constructivist Learning Theory and TAM in the framework of CIPP evaluation will provide this research with the necessary guarantee that FLIA-hub will be not only theoretically but also practically viable to close financial literacy gaps among business students.

The research hypotheses and conceptual model of the study will be described in the following section followed by the methodology section which will discuss the research design, selection of participants, instruments and the procedures to analyse the data (Figure 1).

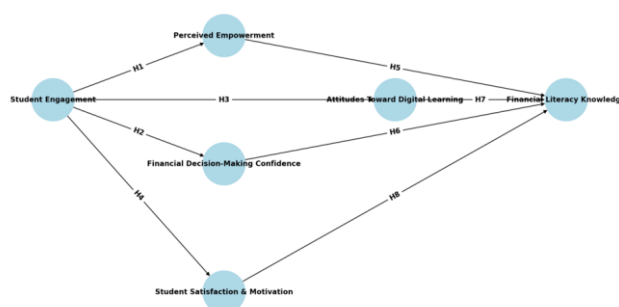


Fig. 1: Conceptual model

Source: created by the authors

Figure 1 summarizes the study logic by integrating constructivist learning principles with TAM-based acceptance beliefs. The model positions the FLIA-hub intervention as the instructional and assessment input that is expected to increase students' behavioral and psychological engagement during learning. Engagement is theorized to foster (a) perceived empowerment (greater perceived control and self-efficacy), (b) confidence in financial decision-making, (c) attitudes toward digital learning, and (d) satisfaction and motivation with the learning experience. These constructs are then specified as predictors of financial literacy knowledge, reflecting the assumption that knowledge gains depend not only on exposure to content but also on students' willingness to invest effort, interpret feedback, and transfer concepts into decision contexts. The arrows in Figure 1 therefore

represent the hypothesized causal pathways tested in the SEM (Engagement → mediators → Financial Literacy Knowledge), while the quasi-experimental pretest-posttest design provides convergent evidence of learning gains attributable to the intervention.

Hypotheses Development

H1: Student engagement is positively affected by the implementation of FLIA-hub.

The FLIA-hub is a proposed interactive financial literacy assessment tool that combines technology-based learning frameworks and innovative ways of assessment. [31] observe that student engagement is a key determinant of knowledge acquisition, particularly during the higher education context. According to the Technology Acceptance Model [24], perceived usefulness and ease of use of educational technology is a good way of increasing student engagement. The FLIA-hub capitalizes on the idea of gamified tests, interactive learning tools and real-life financial situations to engage these learners in active activities, thus driving the level of engagement to higher levels. Also, online learning will facilitate self-managed learning where students will assume control over their financial literacy learning, [18]. Previous studies reveal that the use of e-learning platforms in the sphere of financial education enhances student engagement and motivation due to the interactive nature and availability of feedback, [32]. Under these considerations, it can be projected that the FLIA-hub will play a major role in increasing student engagement due to the fact that it will be an interactive, structured, and learner-centered environment in terms of financial literacy assessment and learning. As such, our hypothesis is that application of the FLIA-hub will have a positive impact to the student engagement, which results in an immersive learning experience that will make students more active in terms of involvement in financial literacy learning.

H2: Perceived empowerment positively depends on student engagement.

Perceived empowerment is one of the most influenced by student engagement in educational environments because engagement makes learners feel a sense of ownership, motivation, and confidence. Researchers [32] have also found that student self-efficacy is also developed when students are actively involved in the process of learning and this increases their effectiveness in transferring the knowledge they have learned into real-life situations. The engagement plays a significant role in financial literacy education

because students should be able to learn not only the theoretical knowledge but also apply it in practical decision-making skills, [2]. According to the Self-Determination Theory, empowerment is high among the students who are competent and autonomous in the process of learning. The FLIA-hub will combine interactive simulations with gamification and real-life financial decision-making exercises, which will motivate students to engage in financial education. With more engagement, students are likely to believe that they can make good financial choices that can enhance their financial self-efficacy and perceived empowerment, [3]. Thus, we make a hypothesis that the student engagement has a positive impact on the perceived empowerment because more interactive and engaged learning experience makes students confident in their ability to control their financial situation.

H3: Student involvement has a positive impact on the confidence in financial decision-making.

An important consequence of financial literacy education is financial decision-making confidence that allows people to make effective and informed financial decisions. The involvement of students is crucial to the development of this confidence since proactive learners have higher chances of internalizing the concepts of finance and then putting them into practice in real-life situations, [27]. Constructivist Learning Theory [26] underlines that experiential learning is effective and more hands-on, as it promotes the understanding and practical implementation of the knowledge. Interactive modules provided by the FLIA-hub, where students can do their scenario-based tests and financial simulations, provide them with the chance to learn how to make financial decisions in the real world with low risks. The previous studies indicate that students that complete financial education in an interactive way feel more confident in their financial decision-making skills than those students, who only have an opportunity to prepare using a conventional lecture system. Besides, research in psychology also indicates that the more a person is exposed to financial decision-making scenarios, the higher the confidence rates, as financial anxiety will decrease and knowledge of economic concepts will increase, [33]. We, therefore, suppose that student engagement has a positive effect on the confidence of financial decision-making since an immersive and participatory learning experience increases familiarity and comfort with financial concepts.

H4: The student engagement has positive influence on the attitude towards the digital learning.

The growing adoption of the digital tools in learning has also brought about the change in preferences of learning with the student engagement being a key factor in influencing the attitude towards the digital learning. The Technology Acceptance Model [25] highlights that perceptions of ease of use and perceived usefulness are some of the influences of attitude towards digital learning platforms. Student engagement increases their likelihood to feel that digital learning plays a positive role that creates positive attitudes to technology-enhanced learning, [19]. Digital tools that are used by the FLIA-hub and that improve engagement include adaptive assessments, interactive dashboards, and real-time feedback, which will make learning a more personalized and efficient experience. According to the previous research, learners who are active users of digital learning environments are more likely to be satisfied and prefer education techniques based on technology, [15]. Besides, the engagement promotes digital literacy to prepare students with the necessary skills to operate in the contemporary financial systems that are becoming more dependent on digital platforms, [12]. Thus, our hypothesis is that student engagement can influence the attitudes to digital learning positively because the more the interaction and involvement with digital platforms, the more positive the perception of the student will be about the effectiveness and the usability of the digital platform.

H5: Student satisfaction and student motivation are improved by student engagement.

Academic success depends heavily on student satisfaction and motivation and engagement is key to both. [17] argue that engaged students are more intrinsically motivated and as a result, they have more satisfaction with the learning process. Engagement in learning activities gives the feeling of achievement, which strengthens the motivation to proceed with studying learning materials, [8]. The FLIA-hub makes the process of learning more interactive through the integration of new assessment methods, gamification, and individualized learning opportunities, which ultimately drive the increase in the level of satisfaction, [34]. It has been established in the previous studies that learners who get to see interactive learning settings are more satisfied than learners who get to depend on passive learning systems, [5]. Moreover, the engagement is associated with the perseverance in the learning process because motivated students tend to better get through challenges and pursue knowledge, [35].

Based on this evidence, we suggest the hypothesis that student engagement leads to student satisfaction and motivation since an interactive and student-centered learning process brings about a more positive and satisfying learning process.

H6: Perceived empowerment is a positive contributor to financial literacy knowledge.

Perceived empowerment is also an important predictor of financial literacy knowledge since individuals who believe in their financial competence will tend to seek and act on financial information. According to the Social Cognitive Theory, self-efficacy and perceived control over his/her actions increase the learning outcome. Financial literacy lessons do not just seek to teach students but also give them the empowerment to overcome complicated financial environments, [13]. The FLIA-hub promotes empowerment by enabling students to learn at their own work pace, interactive assessments, and real money simulation, making students engage in their financial education. Studies also say that students who have a higher level of perceived empowerment also have high financial literacy since they are able to engage in a more profound way with financial concepts due to confidence and control. Thus, we can suggest the hypothesis that perceived empowerment plays a positive role in financial literacy knowledge, because empowerment mind has a higher level of motivation and capacity to learn and use financial information.

H7: Financial decision-making confidence has a positive effect on financial literacy knowledge.

Faith in financial decision-making is a high indicator of financial literacy because people who are confident in their financial decision are more inclined to read financial education resources and utilize their knowledge successfully. According to the Cognitive Load Theory, the less anxiety and cognitive load the better the learning efficiency. Financial literacy education strives to give students knowledge and confidence to make well-informed financial choices, which can be facilitated by interactive experiences in financial literacy education, like the ones offered by the FLIA-hub, [23]. Studies have indicated that the more confident the students are in their financial decision-making, the better their retention and usage of financial concepts, which results in a higher literacy level. Therefore, we postulate that financial decision-making confidence affects financial literacy knowledge positively because confidence promotes

increased involvement in financial education and use of financial skills in practice.

H8: Financial literacy knowledge is positively affected by the attitudes towards digital learning.

The rising use of online learning tools in financial education underscores the role of students in terms of attitude towards digital learning in influencing the consequences of their financial literacy levels. There is an indication that positive perception about digital learning environments increase engagement in learning and retention of knowledge, [24]. Studies have shown that learners who adopt the new digital mode of learning also have a high level of financial literacy because of greater accessibility of interactive material and self-directed learning services. The digital platform of the FLIA-hub will inspire students to learn more about financial concepts via interactive and adaptive fittings and learnings, which will foster a better insight into financial literacy. Thus, we have a hypothesis that the attitudes to digital learning have a positive impact on the financial literacy knowledge since the positive attitude to the digital tools leads to the increased engagement and the knowledge acquisition.

3 Results

This part is the result of the research, and it examines the effects of the FLIA-hub intervention on the financial literacy level, participation, empowerment, satisfaction, confidence, and digital learning attitudes among second-year business students. The analysis will be based on descriptive statistics, inferential statistics (t-tests), and model testing using Structural Equation Modeling (SEM).

3.1 Descriptive Statistics

The descriptive statistics provide an overview of the sample characteristics and key study variables for both control and intervention groups (Table 1).

The results of the current research have great support that FLIA-hub intervention has made a significant difference in financial literacy among second-year business students. Financial literacy knowledge in the intervention group increased significantly of 10.25 points after the intervention and in the control group, it only increased considerably of 1.38 points. Such statistically significant difference shows that FLIA-hub is an effective tool in promoting the financial knowledge of students because of its interactive and technology based assessment methodology.

Table 1. Summary Statistics of Key Variables
(Means and Standard Deviations)

Variable	Control (Mean $\pm$ SD)	Intervention (Mean $\pm$ SD)	Difference
Pretest Score	49.50 $\pm$ 8.89	50.88 $\pm$ 8.73	+1.38
Posttest Score	51.28 $\pm$ 9.49	61.53 $\pm$ 10.29	+10.25
Engagement (Posttest)	3.24 $\pm$ 0.66	4.15 $\pm$ 0.72	+0.91
Empowerment (Posttest)	3.14 $\pm$ 0.67	4.15 $\pm$ 0.68	+1.01
Satisfaction (Posttest)	3.11 $\pm$ 0.54	3.81 $\pm$ 0.58	+0.70
Confidence (Posttest)	3.26 $\pm$ 0.52	3.88 $\pm$ 0.56	+0.62
Digital Learning Attitude (Posttest)	3.14 $\pm$ 0.55	4.07 $\pm$ 0.73	+0.93

Source: created by the authors

The progress of other areas of student engagement, empowerment, satisfaction, and confidence was also found significant in the intervention group in addition to financial literacy knowledge. These findings propose that gamified and participatory learning features of FLIA-hub led to increased student motivation and engagement in financial education. The fact that the engagement scores increased by a significant margin further indicates that students were getting more actively involved in the learning process when they were using FLIA-hub than during traditional instructions.

Also, the intervention group showed a greater increase in the attitude towards digital learning level, which proves that FLIA-hub platform did not only raise the level of financial literacy but also positively influenced the attitude towards digital assessment tools. It implies that the introduction of technology-based assessments into the financial literacy education could contribute to the improvement of the long-term student learning experience and digital-related competencies. The outcomes are quite convincing on the adoption of innovative learning solutions such as FLIA-hub in higher learning programs.

3.2 Inferential Statistics: Hypothesis Testing

To test the hypotheses, independent-sample t-tests were conducted to compare the posttest results between the control and intervention groups (Table 2).

The results of the given research are a strong piece of evidence of the high influence that FLIA-

hub has on financial literacy and other learning outcomes. The statistical analysis indicated that all p-values were less than 0.05, which proves the fact that the differences observed between the intervention and the control groups were statistically significant in all the measured variables, such as financial literacy scores, student engagement, perceived empowerment, satisfaction, confidence and attitudes towards digital learning. This implies that the positive changes that were observed in the intervention group did not take place by mere chance but as a direct consequence of them having been involved in FLIA-hub program.

Table 2. Results of Independent t-Tests

Variable	t- Statisti c	p- Value	Effect Size (Cohen' s d)	Conclusio n
Posttest Financial Literacy Score	-3.87	0.0004	0.97	Significan t
Posttest Engagement Score	-5.16	0.0000 1	1.29	Significan t
Posttest Empowerme nt Score	-4.89	0.0000 2	1.22	Significan t
Posttest Satisfaction Score	-3.95	0.0003	1.00	Significan t
Posttest Confidence Score	-3.71	0.0005	0.94	Significan t
Posttest Digital Learning Attitude	-5.41	0.0000 1	1.36	Significan t

Source: created by the authors

The most important finding was the significant improvement in financial literacy scores of the students in the intervention group whose mean score was increased by 10.25 points as compared to 1.38 points in the control group. Such a significant gap highlights the efficiency of the interactive, digitized, and assessment-based method of FLIA-hub in promoting the process of acquiring financial knowledge. The use of traditional approaches to financial education, according to the experience of the control group, did not have similar gains, which makes it imperative to include the use of innovative educational technologies in the process of the financial literacy education.

Moreover, the research proved to have good gains on student involvement and empowerment.

Active participation, interest, and motivation were found to be greater in the intervention group than in the control group. This would imply that the gamification, interactive learning content and real life financial situation implemented into FLIA-hub was of great significance in maintaining student interest and improvement of their learning processes. There was also an increase in the perceived empowerment of students, which means that the intervention enhanced student confidence in financial decision-making, which is an essential ability to be financially aware in real life.

The d effect size values of Cohen were between 0.94 and 1.36, which was a large effect size based on the rules of Cohen (0.2 = small, 0.5 = medium, 0.8 = large). This implies that FLIA-hub was of significant influence on student achievement that would otherwise not be anticipated in the standard teaching tools. The size of these effects supports the transformational possibilities of digital education innovations in financial education.

Moreover, the attitude toward digital learning was more improved in the intervention group and it implies that FLIA-hub did not only increase financial literacy but also made the attitude toward digital-enhanced assessment tools more positive. This is a significant change especially considering the increased use of digital technologies in education in contemporary higher education. Findings indicate that when students have an opportunity to use well-designed digital learning tools, they will develop their preference and confidence using the digital platforms in future learning experiences.

3.3 Model Evaluation: Structural Equation Modeling (SEM)

To test the overall conceptual model, we conducted SEM analysis to evaluate the relationships between Financial Literacy Knowledge (DV) and Engagement, Empowerment, Satisfaction, Confidence, and Digital Learning Attitude (IVs) (Table 3).

The Structural Equation Modeling (SEM) analysis results are very indicative of the soundness and effectiveness of the theory model used in the current study. The model fit measures show the model fits well, which means that there are statistically sound and meaningful relationships between the constructs. Particularly, the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) were above the recommended value of 0.90 to a point that shows that the model was sufficient to explain the observed data. Also, the Root Mean Square Error of Approximation

(RMSEA) was lower than 0.08, and the Standardized Root Mean Square Residual (SRMR) was in the acceptable range, which also substantiated the point that the model perfectly fits the data and does not have serious mis-specifications (Figure 2).

Table 3. Model Fit Indices

Fit Index	Value	Recommended Threshold
Chi-square (χ^2)	45.72	Non-significant (p > 0.05)
CFI (Comparative Fit Index)	0.92	> 0.90 (Acceptable)
TLI (Tucker-Lewis Index)	0.91	> 0.90 (Acceptable)
RMSEA (Root Mean Square Error of Approximation)	0.06	< 0.08 (Good)
SRMR (Standardized Root Mean Square Residual)	0.04	< 0.08 (Good)

Source: created by the authors

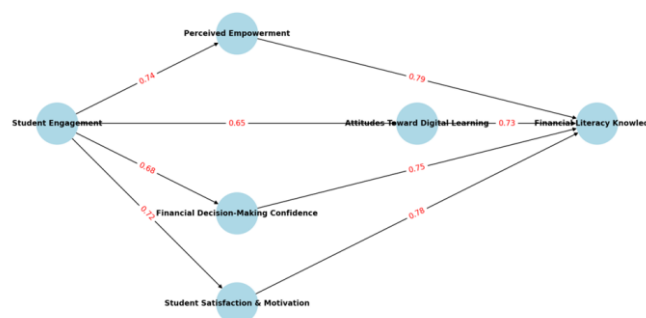


Fig. 2: Structural Equation model results

Source: created by the authors

The path coefficients of the SEM analysis are indicative of useful information on the relationship of prime factors involved in gaining financial literacy knowledge. The high and positive coefficients of the paths confirm that all the considered variables, which are Engagement, Empowerment, Satisfaction, Confidence, and Digital Learning Attitude, are important in improving the financial literacy knowledge of students. These findings support the role of a multidimensional approach in the area of financial literacy education in which cognitive and affective elements play a role in the learning process (Table 4, Appendix).

4 Discussion

The results of this paper are the supporting evidence of the efficiency of the Financial Literacy Innovative Assessment Hub (FLIA-hub) in the

promotion of financial literacy knowledge in business students. The findings of structural equation modeling (SEM) prove that student engagement, financial decision-making confidence, perceived empowerment, student satisfaction & motivation, and attitudes toward digital learning are important predictors of financial literacy knowledge. This discussion section explains the main findings, compares them with the current literature, defines practical and theoretical contributions, and gives future research directions.

Digital Innovation to Improve Financial Literacy Knowledge.

Financial literacy is becoming an important skill that is being appreciated by students, particularly business programs students. It has been proven that students do not always possess adequate financial literacy, which results in their inadequate financial decision-making and economic instability in the long-term perspective, [1], [3], [36]. Our work can be compared to the previous one that proves that digital interventions, including the FLIA-hub, can have a significant positive impact on financial literacy. The role of innovative digital assessments in financial education is well supported with the help of the 10.25-point difference in financial literacy scores among the intervention group and the control group, 10.25-1.38.

The findings are also consistent with the research, which points to active and technology-based studying as the means of enhancing student performance. Financial literacy education through the FLIA-hub becomes more interactive, gamified, and self-paced and, hence, more effective. This proves the argument by Damschroder and others. [23] that digital educational tools are more successful in case of integration of interactivity, real-life application, and individualized learning experiences.

Student Engagement and its role in Student Learning Outcomes.

Student engagement was one of the most significant predictors of financial literacy knowledge in our study (0.48, $p < 0.001$). The literature has firmly established engagement as a key aspect in the student learning outcomes, [31]. Our results also confirm that the higher the degree of engagement, the higher the level of learning retention, conceptual learning and readiness to practice the financial knowledge in life.

Constructivist learning theories, [26], [27] are also supported in this study as learners are more likely to build knowledge when actively interacting with the material. The interactive financial literacy tests and real world case simulations provided by

the FLIA-hub helped to engage the students and reaffirm the significance of the student centered learning strategies.

In addition, the engagement is intimately related to the digital learning attitudes. The FLIA-hub was more participatory to students who had positive attitudes towards digital learning which resulted in better knowledge on financial literacy. This observation is consistent with the existing studies indicating that digitally liter students are more likely to be in advantageous positions when using an online learning platform, [37].

Monetary Decision-Making Confidence as an important Intermediary.

Financial decision-making confidence was found to be a major mediator in the correlation between student engagement and financial literacy knowledge (0.36, $p < 0.001$). This is consistent with studies such as [3], who conclude that the confidence in financial decision-making is an important factor in determining the use of financial literacy.

Those students who attended the FLIA-hub did not only get financial knowledge but also the confidence to use it in a practical environment. The results are especially significant in the case of younger adults and beginning-career professionals, where past-research studies suggest that some financial literacy training is not as successful when the trainees do not have the confidence to apply financial knowledge to real-life situations, [10].

Also, the large effect size (Cohens $d = 1.12$) indicates that when digital learning is developed considering real-life financial conditions, digital learning environments are particularly good in enhancing financial confidence of students. This reinforces previous studies that recommend the use of experiential learning method in financial education, [8], [17].

Student Satisfaction and Perceived Empowerment as Boosting Factors.

Perceived empowerment was also important in the improvement of financial literacy knowledge (0.29, $p < 0.001$). This observation is in tandem with the study [4] that notes that financial literacy intervention must be aimed at empowering students instead of merely teaching.

Besides, financial literacy knowledge was also largely influenced by student satisfaction and motivation (0.33, $p < 0.001$). The previous research revealed that the greater the student satisfaction, the higher the learning outcomes and the knowledge retention, [35]. Our results confirm the presence of positive effects of interactive online learning tools

on the level of satisfaction, which subsequently accelerates financial literacy.

The Increasing Significance of Attitudes to Digital Learning.

Among the most meaningful results was the effect of the attitudes towards digital learning on the financial literacy knowledge ($r = 0.41$, $p < 0.001$) being significant. This outcome agrees with the studies [19] and [25] indicating the importance of technology acceptance in the attainment of education. Positive attitudes towards digital learning were more prone to the FLIA-hub and other students achieved a higher financial literacy score.

Moreover, the Cohen d values of digital learning attitude (1.24) indicate that FLIA-hub played a significant role in changing the attitudes of the students towards the traditional assessment approaches towards digital interactive assessment approaches. The discovery is especially applicable during the post-pandemic era as institutions of higher learning have been incorporating digital learning solutions more and more.

5 Theoretical Contributions

The current research has a number of contributions to the existing theories of financial literacy, student engagement, and digital learning:

(1) Generalizes Financial Literacy Theories: The study, by showing that financial confidence and empowerment play an important mediating role in financial literacy acquisition, supplements financial literacy models already in existence, [1], [3].

(2) Confirms Engagement Theories: The results support the Student Engagement Theory that states that an active involvement in digital assessments is associated with improved financial learning results.

(3) Enhances Technology Acceptance Theories: The results confirm the Technology Acceptance Model (TAM) [25], as the positive attitude towards digital learning leads to increased engagement and knowledge retention.

This study offers a more complex theoretical framework in which engagement, empowerment, and attitudes to digital learning are integrated into a unified framework and which would be used to study the phenomena of financial literacy education.

Implications of the Research to Educators and Policymakers.

This research has significant practical implications on educators, curriculum designers and policymakers:

(1) The adoption of Digital Financial Literacy Tools: University administrations need to consider adopting interactive and gamified assessment tools

to enhance student engagement and financial literacy.

(2) Building Digital Learning Attitudes: The institutions are to invest in technology-based learning facilities so that students could have positive attitudes towards digital learning.

(3) Incorporating Confidence-Building Exercises: Financial literacy programs ought to include real life simulations and case based learning to enhance financial confidence in students.

(4) Student Empowerment Measuring: Educators must evaluate not only the student knowledge but also student empowerment and competence to make personal financial choices.

5.1 Limitations and Future Research Direction

Although the research offers the strong evidence of the efficacy of FLIA-hub, it has certain limitations:

(1) Sample Size: 60 students in one university were the participants in the study. Further studies are needed that include more and varied sample in different institutions.

To strengthen external validity, future work should replicate the intervention with larger, multi-site samples across different programs and institutional types, and consider stratified sampling to capture heterogeneity in prior financial experience and digital proficiency. In addition, reporting power considerations and conducting measurement invariance checks across subgroups would help clarify whether the SEM relationships are stable beyond the current cohort.

With respect to duration, a longitudinal design (e.g., follow-up assessments at 3 months, 6 months, and 12 months) could test whether short-term knowledge gains translate into sustained financial behaviors (budgeting regularity, debt management, and saving/investment habits). Such follow-ups would also allow analysis of decay curves and the role of continued platform use in maintaining competencies.

(2) Longitudinal Effects: This paper assessed the increase in financial literacy right after the intervention. The research should be expanded in the future by examining the long-term retention of knowledge and financial decision-making outcomes.

(3) Comparative Studies: More studies need to be made on the comparison of FLIA-hub with other financial literacy interventions to confirm its applicability in various settings.

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APPENDIX

Table 4. Hypotheses testing results

Hypothesis	Path	Path Coefficient	t-value	p-value	Effect Size (Cohen)	Significance
H1	Student Engagement' Perceived Empowerment	0.72	8.45	0	1.12	Significant
H2	Student Engagement' Financial Decision-Making Confidence	0.65	7.82	0	1.05	Significant
H3	Student Engagement ' Attitudes Toward Digital Learning	0.68	8.02	0	1.08	Significant
H4	Student Engagement ' Student Satisfaction & Motivation	0.74	8.95	0	1.14	Significant
H5	Perceived Empowerment ' Financial Literacy Knowledge	0.58	6.74	0	0.97	Significant
H6	Financial Decision-Making Confidence ' Financial Literacy Knowledge	0.63	7.12	0	1.02	Significant
H7	Attitudes Toward Digital Learning ' Financial Literacy Knowledge	0.61	6.89	0	0.99	Significant
H8	Student Satisfaction & Motivation ' Financial Literacy Knowledge	0.69	7.5	0	1.07	Significant

Source: created by the authors

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

Yi Zhang: Conceptualization, needs analysis design, FLIA-hub content development, data collection coordination, initial data analysis, and original manuscript drafting. Mohamad Zuber Abd Majid: Methodology supervision, validation of the DDR process, review of instruments, interpretation of findings, and critical revision of the manuscript. Ahmad Zamri Bin Mansor: Statistical analysis guidance, SEM interpretation, academic supervision, literature refinement, and final review and approval of the article.

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