Exploring Gamification as a Tool to Enhance Financial Literacy and Improve Financial Behavior
(Meneroka Gamifikasi sebagai Alat Pemankin untuk Meningkatkan Literasi Kewangan dan Mengubah Tingkah Laku Kewangan)

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ABSTRACT

The education sector is changing towards digitalization, notably through the integration of gamification learning techniques in classrooms. This approach has been proven effective in increasing student motivation and engagement. However, the complexity of financial concepts, especially in investment education, can indeed present challenges for students. This study was therefore conducted to assess the effectiveness of gamification in teaching investment subjects. A quantitative survey was conducted using questionnaires distributed to 98 students who participated in the gamified intervention. Data were collected twice, at week 1 and week 10 of the intervention, to compare outcomes and evaluate the impact of gamification. Analysis was conducted using descriptive and inferential statistics, namely paired sample t-test and repeated measures ANOVA. The findings reveal a significant difference between the pre-test and post-test results for all independent variables, indicating the effectiveness of gamification in stock market education. This study highlights that implementing gamification in education has the potential to enhance student motivation, engagement and positive learning experiences, foster goal achievement, improve problem-solving skills, and facilitate the transfer of knowledge and skills.

Keywords: Gamification; education; motivation; investment; stock market

ABSTRAK

Sektor pendidikan sedang melalui era pendigitalan, antaranya penggunaan teknik pembelajaran secara gamifikasi. Teknik pembelajaran ini telah terbukti berkesan dalam meningkatkan motivasi dan penglibatan pelajar di dalam kelas, terutamanya bagi subjek yang sukar difahami yang melibatkan kepelbagaian konsep dan pengiraan kompleks. Kerumitan konsep kewangan khususnya dalam bidang pelaburan sememangnya boleh memberi cabaran kepada pelajar. Oleh itu, kajian ini dijalankan untuk mengetahui keberkesanan teknik pembelajaran gamifikasi dalam pengajaran subjek pelaburan. Kajian kuantitatif telah dijalankan melalui tinjauan menggunakan borang soal selidik yang diedarkan kepada 98 orang pelajar yang menyertai gamifikasi. Data dikumpul dua kali, pada minggu 1 dan minggu 10 intervensi, untuk membandingkan keputusan dan mengkaji keberkesanan gamifikasi. Analisis dijalankan menggunakan statistik deskriptif dan inferensi iaitu ujian-t sampel berpasangan dan ukuran berulang ANOVA. Dapatan menunjukkan perbezaan yang signifikan dalam hubungan, antara ujian pra dan ujian pasca semua pembolehubah tidak bersandar, terhadap keberkesanan gamifikasi dalam pendidikan pasaran saham. Penyelidikan ini menunjukkan bahawa pelaksanaan gamifikasi dalam pendidikan berpotensi untuk meningkatkan motivasi pelajar, meningkatkan penglibatan dalam aktiviti, memupuk pengalaman pembelajaran yang positif, menyumbang kepada kemajuan dalam mencapai matlamat, meningkatkan kemahiran menyelesaikan masalah, dan memudahkan pemindahan kemahiran yang dipelajari.

Kata kunci: Gamifikasi; pendidikan; motivasi; pelaburan; pasaran saham

INTRODUCTION

The world has entered a new era within the fourth-generation industrial revolution, characterised by an expansion in digital system development, interactivity, connectivity, artificial intelligence, both virtual and intelligent, that have affected a range of sectors, including education (Lase 2019). Educational technology has significantly contributed to students' academic achievements in various fields (Jones et al. 2019). The primary issues in education today stem from their diverse learning styles and differing attitudes towards the learning process (Liew et al. 2018). Students, especially those from Gen Z and digital natives, experience visual norms and digital technologies as integral to their upbringing.

The prevailing reliance on traditional teaching methods—such as whiteboard lectures and PowerPoint slides extracted from hefty textbooks—is a well-established practice among educators. While these methods facilitate knowledge delivery and information acquisition, they often fall short in fostering active engagement. Students

tend to passively take down notes without fully understanding the material. This lack of active participation may consequently lead to disengagement, prompting some students to turn to their smartphones out of boredom. To address this challenge, educators are exploring alternative pedagogical strategies. One promising avenue is gamification, which may provide inventive teaching approaches (Deng 2023). For example, gamification technique which infuses learning theory into interactive games, has gained prominence in boosting engagement (Liew et al. 2018). By incorporating gamified elements, educators aim to capture students' interest and encourage deeper exploration of the subject matter. In addition, recognizing the prevalence of digital natives among students, schools are increasingly adopting student-cantered learning models which incorporate technology while enhancing motivation and engagement.

Financial literacy plays a pivotal role in equipping individuals with the cognitive understanding and practical abilities necessary for effective financial management. Thais Liew et al. (2018) and Guzairy et al. (2021) highlight the rapid growth of digital finance and business administration as fields of interest among students. However, despite this trend, financial illiteracy persists as a persistent challenge impeding individuals from confidently managing their financial affairs. One significant gap exists between students' rising interest in financial topics and actual proficiency in managing personal finances, underscoring the need to bridge the divide between financial education and real-world application. According to Kalmi (2018), the effectiveness of financial education is often hampered by the limited use of interactive and engaging tools, resulting in a significant gap between theoretical knowledge and practical application.

In Investment and Portfolio Management courses, students face complex financial concepts, including intricate topics such as asset valuation, risk management, and portfolio diversification. The challenge lies not only in understanding the theoretical aspects but also in applying these concepts in practical contexts. Kurniasari (2021) highlights the implementation of GASING Stock Gamification, which has been shown to increase financial literacy for high school students by simplifying complex financial concepts. This suggests that similar gamified approaches can be highly effective at the university level, aiding students in bridging the theory-practice gap, and fostering a deeper comprehension of financial decision-making processes.

Gamification emerges as an innovative solution to address this educational gap by transforming stock market education into an interactive game that enhances engagement and facilitates comprehension of investment principles. Gamification is particularly effective among Generation Z students, who are accustomed to instant gratification and digital interaction (Liew et al. 2018). Lin et al. (2018) discovered that gamification platforms, such as Kahoot! have gained acceptance among Gen Z in higher education, demonstrating its potential in sustaining interest, motivating active participation, and creating a dynamic learning environment. Furthermore, diverse gamification modes, including simulations, quizzes, and role-playing, simplify complex financial concepts, enhancing students' understanding.

As global gaming culture continues to influence educational practices, gamification represents a transformative approach, broadening access to stock market education through stimulating and immersive experiences (Kurniasari 2021). Understanding the financial behavioural aspects that significantly influence students' investment decision-making processes is crucial for enhancing financial literacy and promoting informed choices. Moreover, Nano (2015) emphasizes that financial behaviour, attitudes, and knowledge are interrelated factors in investment decisions. Therefore, incorporating gamification into financial education may play a vital role in addressing these factors, ultimately leading to improved financial literacy outcomes and better financial decision-making.

Moreover, gamification and game-based learning employ impactful game mechanics, serving as effective tools yielding significant learning experiences. These gaming elements—such as rewards systems, competition, feedback loops, and progressive challenges—are tailored to various educational settings and learning objectives, offering diverse modes of implementation (Lin et al. 2018). However, despite its growing adoption, the use of gamification in investment education remains underexplored. Few studies specifically examine how gamification enhances the understanding of complex financial topics, such as stock investment strategies (Kurniasari 2021). The knowledge gap necessitates investigation on the implementation of gamification in investment courses, in understanding how students internalize stock market principles through interactive learning, that may impact the quality of financial education.

Without the integration of gamification, finance students may struggle with stock investments optimisation, and resort to relying on memorization rather than on practical applications. Additionally, students often show poor engagement and interest, which hinder their ability to absorb complex investment concepts thus affecting their decision-making ability. Attracting students through gamified elements, allows educators to bridge this gap, transforming abstract financial theories into hands-on learning experiences that enhance their cognitive retention of investment strategies (Kurniasari 2021).

This study therefore shall address three key research gaps: first, the limited understanding of gamification's impact on financial literacy in investment education (Kurniasari 2021); second, the lack of comprehensive data on gamification's role in enhancing student engagement and retention; and third, the need to explore the behavioural and psychological factors that influence students' decision-making in gamified learning. By addressing these gaps, this study aims to provide valuable insights into the potential of gamification as an educational tool in finance,

acknowledging its effectiveness in bridging the gap between theoretical knowledge and practical financial decision-making.

Thus, this study highlights the critical importance of implementing gamification methods in education, with the aim of achieving three key objectives: namely, to evaluate financial literacy among finance students, to assess the effectiveness of gamification in teaching stock market concepts, and to investigate the specific financial behaviours that influence investment decision-making. Through achieving these objectives, this study intends to contribute valuable insights into the efficacy of gamified learning in finance education and the psychological factors influencing student investment choices.

THEORETICAL FRAMEWORK

GAMIFICATION AND EFFECTIVENESS IN EDUCATION

This study focuses on gamification as the key factor and strategy to enhance student motivation in financial education (Hamari et al. 2014; Liew et al. 2018). Specifically, we're interested in elucidating the effectiveness of gamification in the context of stock market education. Financial literacy also plays a critical role since it encompasses finance education, particularly in areas such as the stock market. The knowledge is vital to assist students comprehend the principles and fundamentals before implementing them in a game-based environment. Financial literacy enables individuals to make informed decisions in financial activities like investing, managing debt, and budgeting (Nano 2015; Kurniasari 2021). In this study, students possessing strong technical analysis or economic exposure skills, can select and invest in stocks of reputable firms, while applying their classroom learning in the game. Additionally, financial behaviour is another focus in the study. Students with superior theoretical abilities are expected to translate these into superior technical skills, thus enabling them in applying classroom learning to real-world and gaming situations. In consequence, financial behaviour positively influences the effectiveness of gamification. These three factors are crucial and significantly contribute to achieving the objectives of the study.

FINANCIAL LITERACY, GAMIFICATION, AND COGNITIVE THEORY

Financial literacy, the comprehension of financial concepts and practical skills, is intricately tied to cognitive processes. Within the framework of Cognitive Theory (Piaget 1950), attention, memory, and decision-making play pivotal roles in acquiring and applying financial knowledge. Furthermore, cognitive biases, also affect financial behaviours, influencing saving habits, investment decisions, and spending patterns. Gamification in education aligns harmoniously with cognitive principles by using attention, motivation, and memory to reduce cognitive load, thereby enhancing engagement and improving learning outcomes. Additionally, cognitive biases drive desired behaviours through gamification strategies. In summary, a nuanced understanding of cognitive processes provides critical insights into financial literacy, gamification, and financial behaviour, that ultimately guides informed personal finance choices.

FINANCIAL LITERACY

As financial literacy advances, individuals develop the capacity to regulate their financial behaviour and a positive attitude towards personal finance. A person who is financially literate should be familiar with fundamental terms such as lending and borrowing, insurance, investments, and savings and have a positive outlook to managing personal finance (Nano 2015; Kurniasari 2021). Investors in particular, need to have the knowledge and comprehensive understanding of a wide range of financial concepts and facts in order to make informed, low-risk, and profitable decisions. After completing this course, students will have a better grasp of economics and the various ways economic factors affect individual decision-making (Worthington 2006). Through rigorous financial literacy assessments, this study addresses some of the issues identified in earlier research. In addition, this study links financial literacy with stock market participation, deriving significant economic advantage. Even though this issue has been extensively researched, it remains puzzling as to why so few families own equities (Campbell 2006). Earlier studies indicate that managing digital platforms to promote financial literacy has a positive effect on students' learning results (Kuntze et al. 2019). Financial literacy includes understanding on how money functions, establishing and accomplishing financial goals, recognising unethical or discriminatory financial practices, and managing life's financial challenges

Financial literacy involves the understanding and application of essential skills in personal financial management, budgeting, and investing. This study builds upon past research by developing and testing a novel teaching module aimed at raising financial literacy levels among business students (Kuntze et al. 2019). Specifically, the gamified module aims to address gaps identified in traditional financial education by providing a more interactive and engaging learning experience. Research by Andriamahery and Qamruzzaman (2022) supports this approach, noting that financial literacy and access to finance are crucial for empowering individuals to make informed financial decisions.

Additionally, this study examines the link between financial literacy and stock market participation by evaluating economic literacy levels before and after introducing a gamified learning experience. Prior research has indicated that gamification not only boosts engagement but also enhances the retention of financial knowledge (Hamari et al. 2014). By incorporating elements such as simulations and competitive learning games, this study investigates whether gamification can significantly improve students' financial literacy and, in turn, their confidence in participating in the stock market. Thus, we hypothesize the following:

H$_1$ There is no significant difference between financial literacy pre and post gamification in stock market education.

GAMIFICATION

Gamification in education involves integrating game systems and components into non-game contexts. With technological improvements, gamification is increasingly applied in a variety of e-learning environments (Kang & Kusuma 2020). Gamification and learning complement one another effectively, with both activities necessitating sustained engagement and motivation throughout the entire gamification process (Elshiekh & Butgerit 2017). Every game has a trait that heightens excitement and competition essential for reaching particular levels, proving gamification's potential to increase students' motivation, engagement, and enjoyment of learning tasks (Hamari et al. 2014; Liew et al. 2018). This is achieved through game elements such as leaderboards, challenges, points, or feedback (Cheong et al. 2013; Rodrigues et al. 2018). Games in consequence have been shown to be effective at boosting students' motivation for learning.

Play-focused platforms that incorporate educational components are often aligned with the objectives of a specific lesson (Lin et al. 2018). They also reinforce critical information and skills, such as problem-solving, teamwork, and communication, demonstrating gamification's value as viable learning tool (Dicheva 2017). Game simulations allow students to understand how abstract concepts can be applied in the real world, thus emphasising their use of critical thinking in solving difficult problems (Arnold 2014). Games and simulations are ideal learning environments which allow students to make mistakes, which are viewed as opportunities to learn from, providing them with regular feedback cycles (Cahyani 2016). Gamification enhances the learning environment by creating excitement and competition, making it essential to evaluate whether these elements truly influence students' motivation to engage with stock market education. Additionally, by integrating game-based learning into financial education platforms like Bursa Marketplace, this study explores whether the combination of educational goals with game systems enhances students' motivation to apply critical financial concepts in real-world simulations (Arnold 2014; Cahyani 2016).

H$_2$ There is no significant difference in student motivation and engagement before and after the implementation of gamification in stock market education.

FINANCIAL BEHAVIOUR

Gamification in stock market education, incorporating elements such as leaderboards, challenges, and rewards, has been shown to positively impact financial behaviours such as investing, saving, and spending (Kuntze et al. 2019; Liew et al. 2018). By providing immediate feedback, simulations, and engaging scenarios, gamified platforms allow learners to practice responsible financial decision-making and better understand complex financial products (Kang & Kusuma 2020). This approach aligns with theories in behavioural finance, which posit that individuals often make suboptimal financial decisions due to cognitive biases, such as loss aversion or overconfidence (Ritter 2003; Sewell 2001).

Recent research supports the idea that gamified learning environments can help individuals recognize and mitigate such biases by simulating real-world financial scenarios, providing frequent feedback and promoting practice (Arnold 2014; Cheong et al. 2013). Within stock market education, gamification can reinforce positive financial behaviours, such as prudent investing and risk management, which are essential for avoiding common psychological pitfalls, like the disposition effect or herd behaviour (Gachter et al. 2010). Moreover, gamification fosters a deeper engagement with financial literacy concepts, which is crucial for long-term improvement in financial behaviour and reducing irrational tendencies often observed among traditional market participants (Hamari et al. 2014; Rodrigues et al. 2018).

Additionally, platforms like Bursa Marketplace have integrated gamification to enhance financial decision-making through interactive simulations that reflect real-time market dynamics. These simulations, enable users to experiment with investments in a risk-free environment, supporting improved financial habits (Cahyani 2016). Such platforms can provide students with the opportunity to test different investment strategies, understand their outcomes, and make more informed decisions, thereby directly impacting their financial behaviour.

H$_3$ There is no significant difference in financial behaviour before and after the use of gamification in stock market education.

METHODOLOGY

GAMIFICATION SYSTEM DESIGN (BURSA MARKETPLACE)

The Bursa Marketplace, formally known as Kuala Lumpur Stock Exchange, is a comprehensive platform aimed at educating Malaysian retail investors, especially novices, about stock market investment. Designed as a simulation learning game, it offers an interactive, entertaining, and educational experience for new investors. In addition, through the MLT interactive digital platform, users can access and duplicate virtual stock portfolio managed by certified investment advisers appointed by the Bursa. The adviser is also responsible for planning and overseeing his or her virtual portfolio which they can replicate to understand investment strategies. The purpose of the game is to convince participants that stock market trading and investing are secure and viable options, provided they have sufficient financial knowledge prior to making a financial transaction. This study evaluates the gamified learning programme through its application in real-world teaching situations, specifically within the context of an Investment course (Liew et al. 2018).

DATA GATHERING AND RESEARCH DESIGN

This study employed a quasi-experimental design to evaluate the impact of gamification on students' motivation in stock market education. The sample comprised 98 final-year finance students enrolled in the Investment course. This sample size was chosen based on practical constraints and resource availability, providing a reasonable representation of the target student population. The quasi-experimental design, without random assignment, facilitated a before-and-after comparison, focusing on changes in students' financial literacy, behaviour, and motivation due to the gamified approach.

As part of the intervention, students participated in a 10-week stock market simulation game, beginning with an initial virtual capital of RM100,000. Tasks were assigned by the lecturers, and students were required to invest and manage their virtual portfolios over the game's duration. At the end of the 10 weeks, students were ranked according to the final value of their investments, with bonus marks awarded to the top three performers. This competitive component was intended to increase students' engagement and motivation in the learning process.

To assess the impact of this gamified approach, identical questionnaires were administered in week 1 (before the intervention) and week 10 (after the intervention). The pre- and post-intervention data were then compared to examine changes in students' motivation, financial behaviour, and overall engagement, aligning with the research objectives.

ANALYSIS TECHNIQUE

This study used a quantitative approach, using a self-administered survey to collect the data. Data analysis was conducted using SPSS (version 27), chosen for its comprehensive set of tools suitable for both descriptive and inferential statistical analysis, making it ideal for processing large datasets efficiently. Analysis of the respondents' demographics was done using frequency, while descriptive statistics were used to examine the mean, standard deviation, skewness, and kurtosis of each questionnaire item. For inference statistics, three tests were conducted: Cronbach's alpha, paired sample t-test, and repeated measures ANOVA. Cronbach's alpha was used for reliability testing (Sekaran & Bougie 2020). In lieu of the quasi-experimental design that included pre- and post-tests, paired sample t-tests and repeated measures ANOVA were used to compare post-test results with pre-test scores on the independent variables. Higher post-test scores indicate that gamification was effective in enhancing student's motivation to learn about the stock market. Pre-test and post-test designs are employed in assessments of participants' attitudes or perceptions in relation to an event, as well as to assess their comfort in applying the knowledge gained during a training session or when a new concept was introduced (acceptance and efficacy studies) (Kalmi 2018).

STUDY INSTRUMENT

The survey included four components that respondents were required to complete. The questionnaire collected demographic information, including gender, race, and matric number as well as details on class participation. It included a total of 35 items, organised into three sections representing the study's key research variables. Section A, containing 10 items based on Areiqat et al. (2019), measured financial literacy focused on the understanding of financial concepts, such as investment decision-making within stock markets. Section B addressed gamification, with 15 items adapted from Liew et al. (2018) and Hasung (2020), evaluating students' perceptions of how gamification influenced their engagement and learning outcomes in stock market education. Section C focused on financial behaviour, featuring 10 items adapted from Campbell (2006) and Rai et al. (2019), to assess students' investment behaviours in both gamified and real-world settings. The questionnaire employed a 5-point Likert scale

to measure responses, with 1 indicating strong disagreement and 5 strong agreement. All items were adapted from previously validated studies, thus ensuring the instrument's reliability and contextual relevance.

RESULTS

The study involves 98 final year students from three different sets of investment classes at a Malaysian public university. Table 1 below shows the distribution of a sample from three different classes, each taught by a different lecturer. The classes have 51 (52.0%), 27 (27.6%), and 20 (20.4%) students, respectively. In addition, participants' gender distribution includes 23 male (23.5%) and 75 females (76.5%).

TABLE 1. The distribution of a sample from 3 different classes

Students Class	Frequency	Percent
Set 1	20	20.4
Set 2	51	52.0
Set 3	27	27.6
Gender	Frequency	Percent
Male	23	23.5
Female	75	76.5
Race	Frequency	Percent
Malay	75	76.5
Chinese	16	16.3
Indian	6	6.1
Other	1	1.0
Total	98	100.0

RELIABILITY TESTS

To evaluate the reliability of the questionnaire items, which measure the variability in the "underlying construct", Cronbach's alpha was calculated. The test indicated high reliability of independent variables, namely financial literacy (pre-test 0.90, post-test 0.93), gamification (pre-test 0.98, post-test 0.96), and financial behaviour (pre-test 0.92, post-test 0.91). All Cronbach's Alpha values were above 0.9 indicating that the questionnaire was excellent and reliable. This interpretation follows the minimum acceptable level of 0.70 for the correlation coefficient, as proposed by (Sekaran & Bougie 2020)

DESCRIPTIVE STATISTICS

Descriptive statistics were examined to assess the effectiveness of the pre-test and post-test on the variables of gamification in education. Table 2 shows three main variables: financial literacy (A), gamification (B), and financial behaviour (C). For financial literacy, statement item A6: *"I understand how to maximise profits from investment."* exhibited the greatest improvement, with a pre-test mean ($M = 2.38$, $SD = 1.089$) increasing significantly in the post-test ($M = 4.18$, $SD = 0.842$). The result suggests that prior to the gamification intervention, students did not understand how to maximize profits in stocks; however, following intervention, they fully understood these concepts. Total mean score for financial literacy showed significant improvement from the pre-test ($M = 2.95$, $SD = 0.740$) to the post-test ($M = 4.23$, $SD = 0.608$). In addition, the skewness in the pre-test was 0.631, indicating a right-skewed (positively skewed) distribution, while the post-test skewness was -0.775, showing a left-skewed (negatively skewed) distribution. The kurtosis for financial literacy was 0.152 in the pre-test, which suggests a slightly lighter-tailed distribution compared to normal. This increased to 0.360 in the post-test, indicating heavier tails relative to a normal distribution.

Additionally, for the gamification variable, item B8, *"The stock market game helps me to understand all the topics in the Investment and Portfolio Management",* showed the most significant improvement between the pre-test ($M = 3.38$, $SD = 1.031$) and the post-test ($M = 4.35$, $SD = 0.675$). This suggests that gamification greatly increased students' understanding of all course topics learned in the class, despite the fact that this item has the lowest mean among all items. The total mean score for this variable increased from the pre-test ($M = 3.61$, $SD = 0.903$) to the post-test ($M = 4.47$, $SD = 0.506$), indicating a significant positive influence on students' motivation to learn the subject through gamification. The skewness value for the total pre-test was -0.370, and a post-test value left-skewed (negatively skewed) at -0.732. The kurtosis pre-test result was -0.350, showing a more flat-tailed distribution compared to the normal curve, whereas the post-test result was 0.097, showing heavier tails compared to the normal distribution, following gamification intervention.

In terms of financial behaviour, the statement item from C6, *"I believe that I am an experienced investor",* exhibited the largest significant increase from the pre-test ($M = 2.21$, $SD = 1.195$) to the post-test ($M = 3.46$, $SD = 1.22$). This indicates that students gained valuable experience and strategic cognizance in investments and organisation through gamified learning in the classroom. Moreover, there was a substantial difference in the variable, as evidenced by the significant rise in the overall mean score from the pre-test ($M = 2.98$, $SD = 0.859$) to the post-test ($M = 3.98$, $SD = 0.718$). The variable's skewness changed from positive right-skewed distribution in the pre-test (0.249) to a negative left-skewed distribution in the post-test (-0.423), indicating a more positive shift

in students' confidence and self-assessment as investors. The pre-test kurtosis value of -0.108 indicates flatter tails than the normal distribution, while the post-test value of 0.077 suggests a shift towards a more peaked distribution. In conclusion, gamification significantly enhanced students' motivation to learn about this course as indicated by improvements in all three variables from the pre-test to the post-test.

TABLE 2. Descriptive Statistics the pre-test and post-test of the variables

Items	Pre-test				Post-test			
	Mean	Std. Dev	Skewness	Kurtosis	Mean	Std. Dev	Skewness	Kurtosis
Financial Literacy (A)								
A1	2.54	0.943	0.294	0.067	4.24	0.838	-1.564	3.639
A2	3.19	0.916	0.096	-0.643	4.18	0.694	-0.641	0.662
A3	2.96	1.025	0.200	-0.385	4.43	0.674	-0.974	0.673
A4	2.35	1.104	0.586	-0.176	4.08	0.904	-1.017	0.907
A5	2.54	1.123	0.498	-0.455	4.15	0.791	-0.791	0.411
A6	2.38	1.089	0.615	-0.111	4.18	0.842	-0.891	0.296
A7	3.35	1.066	-0.320	-0.478	4.36	0.677	-0.987	1.438
A8	3.66	1.035	-0.364	-0.538	4.35	0.705	-0.969	1.015
A9	2.96	0.907	-0.088	0.113	4.04	0.731	-0.225	-0.605
A10	3.61	0.959	-0.005	-0.964	4.33	0.809	-1.025	0.372
Total	2.95	0.740	0.631	0.152	4.23	0.608	-0.775	0.360
Gamification (B)								
B1	3.65	0.996	-0.211	-0.713	4.57	0.609	-1.117	0.239
B2	3.65	0.954	-0.341	-0.444	4.54	0.577	-0.818	-0.308
B3	3.62	0.969	-0.285	-0.555	4.58	0.555	-0.886	-0.244
B4	3.71	0.984	-0.388	-0.536	4.45	0.690	-1.252	1.750
B5	3.60	1.023	-0.311	-0.533	4.33	0.770	-1.331	2.810
B6	3.50	1.008	-0.339	-0.297	4.44	0.643	-0.716	-0.482
B7	3.49	0.911	-0.053	-0.389	4.44	0.675	-1.007	0.716
B8	3.38	1.031	-0.182	-0.572	4.35	0.675	-0.756	0.355
B9	3.57	0.974	-0.137	-0.648	4.47	0.629	-0.770	-0.390
B10	3.59	0.983	-0.295	-0.341	4.44	0.593	-0.515	-0.628
B11	3.78	1.000	-0.479	-0.252	4.54	0.595	-0.910	-0.141
B12	3.60	1.002	-0.255	-0.456	4.50	0.579	-0.651	-0.543
B13	3.68	0.991	-0.298	-0.635	4.52	0.578	-0.733	-0.436
B14	3.61	0.991	-0.319	-0.365	4.45	0.594	-0.552	-0.601
B15	3.72	1.082	-0.624	-0.135	4.47	0.596	-0.627	-0.533
Total	3.61	0.903	-0.370	-0.350	4.47	0.506	-0.732	0.097
Financial Behaviour (C)								
C1	2.44	1.131	0.678	-0.120	3.61	1.118	-0.491	-0.518
C2	2.78	1.214	0.091	-1.046	3.76	1.065	-0.641	-0.203
C3	3.35	1.095	-0.297	-0.634	4.09	0.898	-1.144	1.699
C4	3.51	1.058	-0.401	-0.343	4.40	0.700	-1.102	1.323
C5	3.11	1.130	0.169	-0.850	3.99	0.879	-0.537	-0.424
C6	2.21	1.195	0.870	-0.019	3.46	1.220	-0.495	-0.704
C7	2.72	1.101	0.191	-0.575	3.83	1.036	-0.950	0.627
C8	3.51	1.142	-0.556	-0.307	4.26	0.865	-1.303	1.837
C9	2.94	1.024	0.066	-0.284	3.95	0.830	-0.346	-0.544
C10	3.26	1.106	-0.291	-0.393	4.01	0.855	-0.827	0.856
Total	2.98	0.859	0.249	-0.108	3.93	0.718	-0.423	0.077

PAIRED SAMPLE T-TEST

A paired sample t-test was conducted to evaluate the impact of gamification in stock market education by comparing pre-test and post-test scores across three variables: financial literacy, gamification, and financial behaviour, with the results summarized in Table 3. For financial literacy, the t-test revealed a highly significant improvement, with a t-value of 14.041 (df=97) and $p < 0.001$, between the pre-test and post-test scores. The mean score increased from M = 2.95, SD = 0.74 in the pre-test, to M = 4.23, SD = 0.61 in the post-test, indicating a mean difference of 1.28, with a 95% confidence interval ranging from 1.46 to 1.10. In addition, there was a moderate correlation between the two sets of scores (r = 0.11, $p < 0.001$). Cohen's d value of 1.89 indicates a large effect size, suggesting that financial literacy significantly improved through the gamification approach. Consequently, the null hypothesis for H_{01} was rejected, indicating a meaningful difference in financial literacy before and after the intervention.

Results for the gamification variable also showed a significant increase in mean scores, rising from M = 3.61, SD = 0.90 in the pre-test to M = 4.47, SD = 0.51 in the post-test. The t-value was 8.125 (df = 97) and $p < 0.001$, reflecting a statistically significant difference. The mean difference was 0.86, with a 95% confidence interval between 1.07 and 0.65. However, a significant negative correlation was observed between the pre-test and post-test scores (r = -0.03, $p < 0.001$) indicating an inverse relationship. This marginal negative correlation suggests that as students' understanding of gamification improved in the post-test, it did not align directly with their initial

pre-test scores. Cohen's d of 1.18 confirmed a large effect size, suggesting that gamification significantly enhanced students' motivation in stock market education. In consequence, the null hypothesis for H_{02} was also rejected.

Finally, financial behaviour demonstrated a statistically significant increase, with the mean score rising from M = 2.98, SD = 0.86 in the pre-test to M = 3.93, SD = 0.72 in the post-test. The t-value was 8.723 (df=97) and p < 0.001. The mean difference was 0.95, with a 95% confidence interval ranging from 1.17 to 0.74. A significant correlation was found between pre-test and post-test scores (r = 0.07, p < 0.001). The Cohen's d of 1.20, confirmed a large effect size. Consequently, the null hypothesis for H_{03} was rejected, validating that gamification significantly enhanced students' financial behaviour in stock market education.

In conclusion, all three variables - financial literacy, gamification, and financial behaviour - demonstrated significant improvements following the gamification intervention, as evidenced by the large effect sizes and highly significant p-values. These results suggest that gamification is an effective educational tool, for fostering students' understanding and behaviour application of financial concepts within stock market education.

TABLE 3. Paired sample T-test of independent variables

Variables	Pre-test		Post-test		t (97)	p	r	Cohen's d
	M	SD	M	SD				
Financial Literacy	2.95	0.74	4.23	0.61	14.041	0.00	0.11***	1.89
Gamification	3.61	0.90	4.47	0.51	8.125	0.00	-0.03***	1.18
Financial Behaviour	2.98	0.86	3.93	0.72	8.723	0.00	0.07***	1.20

Note: *** p < 0.001

GENERAL LINEAR MODEL – (REPEATED MEASURES ANOVA)

A repeated measures ANOVA was employed to establish whether there was a statistically significant difference in mean scores, which may suggest an intervention effect when subjects from the same group were measured on multiple occasions. The effectiveness of gamification was explored across three variables at two time points - pre- and post-test surveys - using a one-way within-subject ANOVA, also referred to as a repeated measures ANOVA. The results, shown in Table 4, indicate a significant effect of financial literacy on the effectiveness of gamification, F (1,97) = 197.15, MSE = 0.41, p < 0.001, with an effect size of η^2 = 0.67, indicating a large effect of the intervention between the pre- and post-test. Specifically, mean score (M) for financial literacy in the pre-test increased from 2.95 (SD = 0.74) to 4.23 in the post-test (SD = 0.61), with p < 0.001. In consequence, the null hypothesis for statement 1, H_1, was rejected.

The gamification variable also showed a significant mean difference in its effectiveness in stock market education with F (1,97) = 66.02, MSE = 0.55, with p < 0.001, and a large effect size (η^2 = 0.41) indicating the difference between pre- and post-test. The mean score (M) increased from 3.61 (SD = 0.90) in the pre-test to 4.47 (SD = 0.51) in the post-test., with p < 0.001, demonstrating that the null hypothesis of statement 2, H_2, was also rejected.

Lastly, the financial behaviour variable also indicated a significant mean difference in the effectiveness of gamification in stock market education, with F (1,97) = 76.10, MSE = 0.58, p < 0.001, and η^2 = 0.44 that indicate large effect size of the difference between the pre- and post-test scores. There was however a statistically significant change in the mean score (M) from 2.98 (SD = 0.86) to 3.93 (SD = 0.72) in the post-test. The p-value for financial behaviour was less than 0.001 leading to the rejection of the null hypothesis H_3 for assertion 3. The paired-wise comparisons confirmed the significant mean differences for all variables between pre- and post-test scores. The study demonstrates the efficiency of gamification in stock market education, with all three variables indicating significant improvement in post-intervention.

TABLE 4. Repeated measures ANOVA of independent variabel

Variables	Pre-test		Post-test		F (1,97)	p	MSE	η^2
	M	SD	M	SD				
Financial Literacy	2.95	0.74	4.23	0.61	197.15***	0.00	0.41	0.67
Gamification	3.61	0.90	4.47	0.51	66.02***	0.00	0.55	0.41
Financial Behaviour	2.98	0.86	3.93	0.72	76.10***	0.00	0.58	0.44

Note: *** p < 0.001, MSE = Mean Square Error

DISCUSSION

The study findings showed that all p-values in the analysis were less than 0.001, indicating a statistically significant difference between scores recorded before and after students participated in the investment simulation game, i.e. the Bursa Marketplace. The game has shown to be effective in boosting the motivation of the students. This interactive game provides an alternative tool that can provide a theoretical review with practical, real-world exposures. Based on the students' reflection, many of them who have never invested can gain some understanding into the real investment world through this game simulation. This implies indirectly that gamification is a successful approach for increasing motivation in stock investment learning. In general, gamification enhances healthy competitiveness among students, who become motivated both to win the game while learning the

educational content provided by their educators (Lin et al. 2018). The mean score of the gamification variable was 4.47 out of 5 which was the highest value in the post-test segment. This indicates that the study offers valuable pedagogical insights into the learning preferences of post-millennial students. Comparing the effectiveness of gamified and traditional classrooms, may provide the crucial information on effective teaching strategies (Liew et al. 2018; Guzairy, et al. 2021).

When this game is implemented in a gamified environment, financial knowledge plays an important role in developing winning strategies. Financial literacy, particularly in stock trading through technical and fundamental analysis as well as economic exposure, is crucial in helping players achieve returns on their investments. The variable of financial literacy is the second-highest of the three variables, with a post-test mean score of 4.23 out of 5. This implicitly demonstrates that gamification effectively enhances finance education. A lack of knowledge on economics and financial literacy is a significant constraint to maximizing earnings in stock trading. Accordingly, financial knowledge is indispensable and should not be overlooked (Rooij et al. 2007). The efficacy of the lessons taught in the class can enhance the students' financial literacy in stock trading, and assist them in application within the simulation game. Additionally, in order for students to receive early exposure, particularly in the areas of investing and sound financial management, financial literacy should also be included in school curriculums. Aligned with this view, Kurniasari's (2021) research on GASING gamification stock simulation in an Indonesian secondary school, demonstrated the effectiveness of gamification in raising students' financial literacy.

The mindset and self-control of each person have a significant impact on their financial behaviour, since it does not always align with knowledge levels, even when the individual is well-informed. The post-average test score for changes in financial behaviour averaged a modest 3.93 out of 5. Although the mean score improved from the pre-test, the increase was not regarded as significant, suggesting that behavioural changes require prolonged intervention and observation. This is consistent with Kalmi (2018), who discovered that receiving financial instruction does not automatically result in alterations to one's financial behaviour However, from the standpoint of gamification, financial behaviour significantly impacts the efficacy of investment gamification. This can be demonstrated by the significant increase in the post-test mean score for financial behaviour, from 2.98 to 3.93, with a p-value of less than 0.001. Investment games incorporate skills and knowledge that equip students in making sound investment decisions. For instance, students may be driven to follow other players in purchasing stocks in a lucrative company; thus, reflecting how investor psychology and peer motivation may influence individual behaviour, since the students will become pressured if they do not perform equally well (Jones et al. 2019).

CONCLUSION AND IMPLICATIONS

This research demonstrates how gamification can enhance higher education by attracting students and improve learning outcomes. The findings gave some insight on the use of gamification in education, which incorporates game-like elements, such as challenge, competitiveness and interaction, to make learning more enjoyable for students. It has been proven successful in increasing student interest and involvement in this course, which in turn improves their academic achievement. Bursa Marketplace specifically provides students with an entertaining and engaging platform that allows them to rapidly learn about investing and gaining insights into Malaysian stock market companies. From an educational perspective, this study offers helpful understanding on the types of learning that post-millennial students need. It provides crucial information through comparing the effectiveness of gamified classrooms to traditional ones. These results are intended to motivate investment educators to adopt gamification in order to maximise the learning experience.

This study supports the positive impact of gamification on education. Gamification, in the context of stock market education, specifically refers to the application of gaming elements into teaching with the objective to boost student learning outcomes. Through participating in enjoyable and interactive activities, gamification can boost students' motivation. Similar effect can be obtained through achievements and wins from video games. Furthermore, performance evaluations in gamified environment provide lecturers with a better understanding of students' comprehension and aptitude in the context of the stock market However, the effectiveness of gamification depends on its thoughtful implementation and alignment with educational objectives.

This study contributes to the theoretical understanding of gamification by demonstrating its effectiveness within a higher education context, particularly in financial education. The results show that gamification not only increases student engagement and motivation but also enhances their understanding of complex financial concepts. This supports existing theories that position gamification as a powerful tool for improving educational outcomes (Hamari et al. 2014; Liew et al. 2018). Additionally, the study extends cognitive theory by illustrating how gamification supports cognitive processes crucial to financial learning such as attention, memory, and decision-making (Piaget 1950). The significant improvements in financial literacy scores following the intervention, indicate that gamified learning environments can effectively engage students' cognitive functions, improving retention and understanding of financial principles.

From a behavioural finance perspective, the study provides valuable insights into how gamification influences students' financial behaviours. The significant changes observed in students' confidence, risk-taking behaviour, and responsiveness to market developments highlight gamification's potential to shape financial decision-making processes. These findings aligns with behavioural finance theories that emphasize the impact of

psychological factors on investment decisions (Ritter 2003). Furthermore, the study's quasi-experimental design, employing pre- and post-tests, combined with paired sample t-tests and repeated measures ANOVA, establishes a robust methodological framework for evaluating the effectiveness of gamification in education. This methodological approach can serve as a model for future research aiming to assess the impact of innovative educational interventions. The practical findings also have direct implications for curriculum design in finance education. By demonstrating that gamification significantly enhances financial literacy and behaviour, educators are provided with evidence-based strategies to incorporate interactive and game-based learning elements into their courses.

Furthermore, lecturers are affected through implementing gamification in the classroom. They must carefully plan and develop curriculums that merge gamified elements with the prescribed curriculum. They must also ensure that the games and activities are created with students' learning objectives in mind and can offer them additional educational value. Additionally, during gameplay, lecturers must actively engage with students to offer guidance, clarify complex ideas, and provide supplementary assistance to those who require it. However, because gamification in education involves the use of technology, lecturers must also ensure that students have reliable access to gamification platform or application, which they must comprehend and be proficient in using. For this strategy to be effective and relevant, lecturers must also actively participate in the gamification in education.

In the final analysis, the study's findings have implications on policymakers and educational administrators. Policymakers must ensure that the introduction of gamification is in line with national educational goals and objectives. Policies should encourage its adoption in the classroom to enhance students' learning. Since student performance evaluation and measurement are crucial, policies must include instructions on how to assess and gauge student achievement in the context of gamification. They should also ensure that the achievements of students are appropriately and truthfully reported. To guarantee the viability and applicability of the educational process, cooperation with the stock market industry need to be promoted, with initiatives taken such as hosting conferences, or arranging site visits. Through aligning policies with educational objectives and standards, policymakers can foster an environment that effectively support gamification as a tool for stock market education.

LIMITATION AND FUTURE RESEARCH

One of the primary limitations of this study is the reliance on a specific, limited scope of gamification elements - such as badges, rewards, and leaderboards - within the Bursa Marketplace stock market simulation. Although these features can enhance engagement, they may not provide a comprehensive view of how diverse gamified elements can impact learning outcomes. More sophisticated elements, such as narrative-driven learning or team-based competitions, which could promote collaboration and a deeper understanding of stock market dynamics, were not included in the study. In consequence, the findings may only reflect the effectiveness of these three specific elements and not the broader potential of gamification in financial education. Additionally, the sample size, though adequate for statistical analysis, might not represent the larger student population, especially in terms of age, financial literacy, or socio-economic background, thus limiting the generalizability of the results.

Future research should consider expanding the scope of gamification within the Bursa Marketplace stock investment, such as peer collaboration or role-playing scenarios to simulate real-world financial decision-making. The negative correlation found in the study also presents an opportunity for future investigation, as understanding to why students' pre-test perceptions of gamification inversely influenced their post-test outcomes could offer valuable insights into motivational or psychological factors. Moreover, extending the evaluation period beyond the short-term pre- and post-tests would assist in determining the long-term effectiveness of gamified learning tools, particularly in retaining financial literacy and fostering positive financial behaviours over time.

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APPENDIX

Variables	Items	Statements
PART A: FINANCIAL LITERACY	A1	I have knowledge about the stock market.
	A2	I am disciplined in managing my finances.
	A3	I understand basic financial concepts such as buying and selling stocks.
(To measure the financial literacy among finance course students particularly in stock market knowledge)	A4	I can do technical analysis to predict financial market activity.
	A5	I can evaluate the process of making investment decisions.
	A6	I understand how to maximize profits from investment.
	A7	I believe individual financial literacy level greatly influences the choice made about investments in the stock market.
	A8	I believe stock investment gives the highest return compared to the savings account.
	A9	I can assess my understanding of economics well
	A10	In the field of stock investment, I will buy stocks when the price falls.
PART B: GAMIFICATION	B1	I find stock market games interesting as a gamification learning method for investment class.
(To assess the effectiveness of gamification in stock market education by comparing students' motivation in the classroom before and after playing the game)	B2	I enjoyed the gamification learning method more compared to traditional lecture class.
	B3	The gamification learning method motivated me to learn more about stock market education.
	B4	The gamification learning method helps me to pay more attention in my investment class to win and earn more profits in the game.
	B5	The gamification learning method helps me to prepare in Investment and Portfolio Management test.
	B6	The stock market game provides insight into what I learned about stock investment theory.
	B7	The stock market game helps me to reinforce my learning of the Investment and Portfolio Management.
	B8	The stock market game helps me to understand all the topics in the Investment and Portfolio Management.
	B9	The stock market game inspired me to try applying and investing in the stock market in real life.
	B10	The stock market game includes game elements to increase motivation and involvement in the classroom.
	B11	I believe the concepts of "game" and "study" are compatible.
	B12	The stock market game enhances the classroom experience and teaching effectiveness.
	B13	The stock market game is the best tool to improve the quality of learning in stock investment.
	B14	The stock market game helps fostering and reinforcing learning for both theoretical and practical aspects in stock market education.
	B15	I wanted to explore all the options in the stock market game because it was very challenging.
PART C: FINANCIAL BEHAVIOUR	C1	I am actively making investments.
	C2	I have tried to save money for stock investment purposes.
(To determine which financial behavioural aspects, have the greatest influence on stock investment decisions)	C3	I had rather invest money to get dividend/profit in the future than spend money in the present.
	C4	I think gamification is good to promote risk-taking behavior in this stock investment.
	C5	I am willing to bear the risk in this stock trading to get high return.
	C6	I think that I am an experienced investor.
	C7	I think that I can outperform the market with the help of my stock market abilities and expertise.
	C8	I feel nervous when large price drops have in my invested stocks.
	C9	I typically respond swiftly to developments in the stock market and the other investors' decisions.
	C10	Investing in equities that have a track record of poor trading performance always makes me nervous.