

Development of Financial Learning Mobile Game

Application for Young Adult Learners

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ABSTRACT

Financial literacy is among the most important skills people should have. With financial literacy, an individual can make sound financial decisions and have proper financial practice, which contributes to the economic growth of society. However, the perception that finance is difficult prevents people from taking full advantage of more complex financial products and services. Besides, conventional financial education is no longer effective in instilling the required financial knowledge and practical skills among young Gen-Zers. This research aims to study how to employ innovative financial learning to engage late teens and young adults to improve their financial education. The empirical survey was conducted to investigate the motivating factors for financial education combined with gamification theory, self-goal setting, and feedback giving for the financial game design to financial education engagement and effectiveness. The game prototype has been developed and implemented with the students aged between 16 and 19 years old who were assigned into an experimental group and a control group with 51 people in each group. The findings reveal statistical differences of financial knowledge test scores at a significant level of 0.5 between two groups. The innovative financial game can enhance the users' financial literacy and attitude, boost up the confidence in their financial management skills, have the capacity to absorb a financial shock, and lead their way of life. Besides, the study shows how the samples embrace the innovative financial game to ease finance learning, the encouragement of knowledge implementation, and further pursuit for financial knowledge.

Keywords

theory of needs, Gamification, game-based learning, financial education, financial game

Introduction

Financial literacy is a vital skill to enable individuals to make sound financial decisions for themselves and their families to achieve financial well-being and security and for the greater good of the country's economy (Lusardi, 2019; Lusardi et al., 2017). However, the existing studies reported that financial illiteracy is widespread, and people lack financial knowledge vital to saving, investing, borrowing, pensions, and other financial related topics. (Hastings et al., 2013; Lusardi, 2019; Lusardi & Mitchell, 2011, 2014; Meier & Sprenger, 2013).

In Thailand, evidence showed that most Thai people across all generations are increasingly struggling with financial debts and financial illiteracy. One-third of Thais have high debts that do not generate income and have an obligation since a young age (Chantararat et al., 2020). Financial knowledge, especially about the concepts of compound interest rate, inflation, and benefits of diversification, remains a significant weakness in Thai households (Bank of Thailand, 2016; Moenjak et al., 2020). Gen-Zers, people younger than 23 years old, are the most vulnerable since their lack of financial literacy can prevent them from making sound financial decisions or

effective financial management. This inadequacy potentially harms the long-term strength of communal and national economic stability (Consumer Financial Protection Bureau, 2015; Hogarth & Hilgert, 2002; Mueangpud et al., 2019; National Reserach Council of Asia, 2015; Peña-López, 2012). Nevertheless, Gen-Zers are willing to learn more about finance (Manager Online Newspaper, 2020).

Despite the perception as complicated and challenging, this generation's financial education can be facilitated by a smart mobile device with 'game-based learning' for convenience, easy to use, portable, and inexpensive. It can also trigger users' enthusiasm, provide learners with rich content, and potentially yield positive results to these young students (Howlett, 2019; Mueangpud et al., 2019; Papadakis et al., 2018; Papadakis et al., 2020a). They grow up surrounded by technology and naturally prefer entertainment and freedom (Cowan, 2014; Jaleniauskiene & Juceviciene, 2015; Turner, 2015). Thus, a successful financial education for these young adults requires goal-setting to achieve financial well-being in this case (Archuleta et al., 2020; Mandell & Klein, 2007). Likewise, according to the Theory of Needs, learners will be motivated to

learn and apply their knowledge for real uses (Machová et al., 2020; Mandell & Klein, 2007; McClelland, 1988), mostly to deal with their financial burden. Besides goal-setting and motivation, another element of financial education is to create an interactive learning process with feedback to encourage the reason for learning (Mandell & Klein, 2007).

This research applies concepts such as Game-based learning, Theory of Needs, and Feedback, for creating a financial gamification/financial game-based application with adjustable goal-setting and immediate feedback. The application can promote learning participation, financial knowledge retention, and consciousness-raising (Machová et al., 2020). Therefore, the objectives of the study are threefold. Firstly, to examine the stimulus factors that motivate students to adopt and engage in the financial game. Secondly, to develop and design the innovative game prototype. Finally, to test the participants' perceptions of benefits from this innovative game by determining whether the prototype can instill knowledge, attitude, and required behavior for financial literacy and well-being.

Literature Review

2.1 Stimulus factors to Acquire Financial Knowledge

This research studies the motivating factors in two aspects: encouraging people to learn new economic concepts and applying knowledge for real-life uses.

The motivation for financial training depends much on individual characteristics and situational characteristics. An individual's factors include cognitive ability and the ability to control to the extent that a person believes he/she has control over things happening to his/her lives to promotes self-interest (Alcivar et al., 2020). Meier and Sprenger (2013) also mentioned that the worthiness of time-spending also contributes to financial learning. A person will prefer the choice worth his time-spending and will likely benefit their distant future to the option, only giving him immediate comfort (Meier & Sprenger, 2013). The study on financial literacy by Jump\$tart, a U.S. non-profit coalition of national organizations, found the financial literacy program's emphasis can be more effective when the program is closely

relevant to learners' ability to achieve (Jump\$tart Coalition cited in (Mandell & Klein, 2007)). Locke & Latham (2006) also suggested that clear goals can lead to strong commitment, capability, and consistency for achievement (Locke & Latham, 2006). Besides, the lack of basic financial concepts and the inability to make sound financial decisions had led to a lack of motivation to study (Mandell & Klein, 2007). The other crucial factor in motivating students to learn is the method (Machová et al., 2020). Students become more engaged in financial learning when they can discover "on-demand" or on their control over the place and time (Hogarth & Hilgert, 2002). This finding coincides with the Bank of Thailand study, which asserts that the digital platform with easy access, such as social media or mobile application, can be the best platform to distribute financial knowledge to generation Y and younger (Bank of Thailand, 2016).

2.2 Gamification and Game-based learning

One of the challenges of promoting financial education is the knowledge implication into routine execution. Gamification, the application of typical gaming elements and principles in other areas or "non-game" context (Deterding et al., 2011), is suggested and introduced as a tool to address such a challenge. The psychological predisposition explains why a person would engage in enjoyable tasks, including playing, allowing players room for a trial, making mistakes, overcoming obstacles, exploring without any negative consequences, and fostering knowledge accumulation and retention (Bayuk & Altobello, 2019; Koster & Wright, 2004; Machová et al., 2020; McGonigal, 2011; Putz et al., 2020; Remnova & Shtyrkhun, 2020). Also, a game situates players in the repeated patterns which they can voluntarily and unconsciously practice (Machová et al., 2020). The game's nature makes it a suitable tool for teaching financial knowledge and building up new routines and behavioral changes (Groh, 2012; Maturo & Setiffi, 2016; Nicholson, 2015; Remnova & Shtyrkhun, 2020; Werbach & Hunter, 2012). However, motivating factors vary across groups of people, so an education game designer should take this finding into account and select the appropriate stimuli to generate the desired outcomes (Bayuk & Altobello, 2019; Putz et al., 2020). All previous

study findings are illustrated as the game design concept as given in Figure 1.



Fig. 1. Game design concept

A game is adopted as one of the most popular methods to promote self-study in formal and informal contexts, attract the learner's attention, facilitate the learning process, and enrich the learning experience (Dondi & Moretti, 2007; Garris et al., 2002). When it comes to the game design process, a game designer should balance the proportion of challenges with players' ability, frustration, and boredom. The game should neither be too difficult nor easy with the progressing difficulty by levels of players' skills or capability to feel challengingly satisfied, experience the achievement, and engage with the game (Ferrara, 2013; Nicholson, 2015; Ryan et al., 2006; Sweetser & Wyeth, 2005; Zichermann, 2013; Zichermann & Cunningham, 2011).

2.3 Perceived Benefits of the Financial Game

The literature review affirms that financial illiteracy can result from the lack of connection between learning goals and personal goals, the lack of feedback, the incompatibility between learned content and real-life situations, and the incompatibility between financial concepts learned and the knowledge level of learners, failing financial learning (Locke & Latham, 2006; Mandell & Klein, 2007). Richard, Williams, Smith & Thyer (2015) assert that a quiz-based game can provide learners an increase in financial knowledge, awareness, and consciousness (Richards et al., 2015). Hence, developing an innovative game-based learning tool aims to enhance financial literacy and raise learners' financial well-being. The tool combines the financial concepts relevant to players' lives, gamification, and game design concepts.

Methodology

3.1 Sampling Frame

This research investigates the factors influencing the financial learning of Thai generation Z. The sampling frame of Gen-Z in Thailand is about 26.5 million (Farrell & Phungsoonthorn, 2020). However, the research

design with semi-experimental use of the prototype game requires a manageable sample size with uniform characterization; hence a convenience sampling is adopted. Respondents are students from the Provincial Electricity Authority Electric Vocational School (PEAEVS) aged between 16 and 19. These students will graduate at around 20 years old to become skilled workers of Provincial Electricity Authority (PEAEVS), a large state-owned enterprise in Thailand's utility sector, so the employees are ensured in terms of professional stability and many fringe benefits. Like a common first jobber in Thailand, these sample students tend to spend their first paycheck on luxury goods, a new technological gadget, or a new-model motorcycle, which puts them in debt soon after the entry into their careers.

The research assumes that the sample students' necessary financial knowledge are selling price, inflation and interest rate, savings, investment (in bond and mutual fund), and risk diversification (insurance included).

3.2 Research process

The research process comprises three phases: Phase-1 identifies the stimulus factors that motivate young adults to adopt and engage in playing a financial game. A careful survey instrument was developed and used with the whole target population of 172 students. The most relevant stimulus factors from the factor analysis are incorporated into the financial game's design in Phase 2.

Phase-2 focuses on designing and testing innovative financial games, which incorporate identified stimulus factors from Phase 1, gamification theory, and game-based learning theory in composing questions used in the game. One hundred and two students joined in the prototype game testing, 51 persons in the experimental and 51 control groups.

Phase-3, mainly assesses the game effectiveness to determine whether this financial, educational tool can improve the target group's financial literacy and well-being. The test includes the players' knowledge, attitude, and behavior

before and after playing the game by comparing scores within the experimental group and between the experimental and control groups. The test also covers the questions to assess game acceptance.

3.3 Data Analysis

Phase-1 and Phase-3 analyze the data with the Statistical Package for the Social Sciences (SPSS). Phase-1 uses Pearson correlation coefficients and Exploratory Factor Analysis (E.F.A.) to determine the stimulus factors for the innovative financial game adoption and engagement. Phase-3 employs the Sample T-Test in comparing assessment scores from different sample groups of the game effectiveness. The game acceptance was assessed on two aspects: 1) Perceived Ease of Use – by applying "System Usability Scale (SUS)," a popular scale developed by John Brooke to quickly measure software or application usability, playability, and learning outcomes by taking into account the unique goals and limitations of time, personnel, and small development (Brooke, 2013); 2) Perceived Usefulness – by applying "EGameFlow" to measure learners' enjoyment of e-learning game on immersion, social interaction, goal clarity, feedback, concentration, control, and knowledge improvement dimensions (Fu et al., 2009).

Results

4.1 Stimulus Factors for Financial Game's Learning and Engagement

This research phase started with the literature review and in-depth interviews with financial experts to understand stimulus factors that motivate students to adopt and engage in innovative financial games. The factors used to develop the initial set of questionnaire consist of: the expectation for a pay rise after knowledge gained, the support from family and social circle, and the determination for self-improvement, financial attitude, social norms, other motivations to learn (cited in (Ackaert & Verhaeghe, 2000; Dæhlen & Ure, 2009; Hubackova & Semradova, 2014; Huitt, 2001; Mandell & Klein, 2007; St.Clair, 2006; Windisch, 2015; Yan et al., 2020)) and inquiry about interest in having a game as an innovative educational tool.

The Factor Analysis found 7 factors with the Eigenvalues of greater than one, accounting

for the cumulative variance of 59.79%. These seven factors are 1) Self-development, 2) Financial planning, 3) Awareness of the importance of financial management, 4) Goal-setting, 5) Social support, 6) Future uncertainty, and 7) Satisfaction of financial status. The variances explained for each factors were 10.729%, 9.168%, 9.149%, 8.968%, 7.883%, 7.756% and 6.140% respectively.

Table 1. Regression coefficients of stimulus factors for learning and interest in the innovative financial game (n=135)

Extracted factors to use in the equation	Regression coefficient (B)	Std. Error	Beta	Sig.
Constant	3.170	.115		.000
Self-development	-.311	.116	-.217	.008
Financial planning	-.017	.116	-.012	.886
Awareness of the importance of financial management	-.117	.116	-.082	.315
Goal-setting	-.419	.116	-.292	.000
Social support	.217	.116	.152	.063
Future uncertainty	-.095	.116	-.066	.413
Satisfaction to financial status	-.063	.116	-.044	.587

Multiple regression analysis was performed on the factor scores of all 7 stimulus factors. The result in Table 1 shows only two stimulus factors for innovative game learning with a significant level of 0.05, including self-development and goal-setting. Nevertheless, the negative regression coefficient value ($B = -.311$ of self-development and $B = -.419$ of goal-setting) show that those less interested in self-development or goal-setting may be interested in playing the innovative game for financial learning. This finding agrees with the study of the Bank of Thailand as well as interviews conducted with experts, which suggested that most Thais regard financial management as stress and burden (Bank of Thailand, 2016) Financial education should be conducted through learning material with enjoyable story-telling such as games so as to bring about positive outcomes as well as the encouragement of positive financial behaviors (Bank of Thailand, 2016; Donnini et al., 2011; Ito, 2009; Loke, 2015).

The researcher measured the internal consistency by Cronbach's Alpha Coefficient to test the reliability of both factors. The Alpha values are 0.711 and 0.727, implying the reliability to use as inputs of innovative financial games to promote financial knowledge and well-being, as shown in Table 2.

Table 2. Cronbach's Alpha Coefficient of stimulus factors for using the innovative financial game

Stimulus factors for using the innovative financial games	Cronbach's Alpha Coefficient
Self-development factors	
1. Financial knowledge is learnable and adaptable for real-life situations.	.711
2. I plan to become a financial expert.	
3. I expect an increase in income in the future.	
4. I am interested in financial knowledge if related to my life.	
Goal-setting factors	
1. I would like to keep my financial knowledge and skills updated.	.727
2. Financial knowledge can help change behavior.	
3. I always set financial goals such as planning for a wedding and having children.	
4. I am interested in investment for wealth accumulation.	

All measurements of the two significant stimulus factors reflect the future orientation of financial concerns, for example, the desire to keep financial knowledge and skills updated, the behavioral change expectation from increasing financial knowledge, the interest in investment for wealth accumulation, the adaptability of financial knowledge in real-life situations, the plan to become a financial expert, and the expectation for income increase. These factors are later used as the elements in the game.

4.2 Design and Development of Innovative Financial Game

4.2.1 The implementation of motivating factors in game design

The game design incorporates the two most significant motivational factors – goal setting and self-development, as shown in Table 3.

Table 3. The incorporation of motivating factors in game design

4.2.2 The relationship between motivating factors in the financial game

The researcher applied the motivating factors for designing an interesting financial game. The setting of sub-goals and main goals requires planning and motivation through a trial-and-error process based on a safe environment and clear positive feedback given to the game player, as shown in Figure 3.

Fig. 3. Trial and Error with Positive Feedback Diagram

Figure 4 shows the tree diagram of Self-development in the game design. The objective is to learn to make a successful financial decision to

Input	Game element
Goal setting	
Always set a financial goal for the future, such as wedding planning and having children	The targeted group can set goals suitable for their conditions.
Want to develop skills and knowledge to keep up with the present	The set of questions must be adaptive and match the current financial landscape.
Believe that financial literacy can transform self-financial behavior	The set of questions can raise awareness for better financial decisions.
Interest in investing and wealth accumulation	The set of questions must include investment and risk avoidance for unexpected situations.
Input	
Desire for self-improvement	Game element
Regard the financial knowledge as what can be learned and applied for real-life situations	The set of questions must be similar to the real-life scenario of sample groups.
Have planned to be skilled/expert in finance	The set of questions must promote the financial literacy of the sample.
Expect a higher salary in the future	The set of questions must be filled with the knowledge of savings for investment.
Interest in financial knowledge related to life issues	The set of questions must be applicable to real-life situations.

achieve long-term economic well-being, such as savings, planned spending, informed consumption, and fundamental financial knowledge.

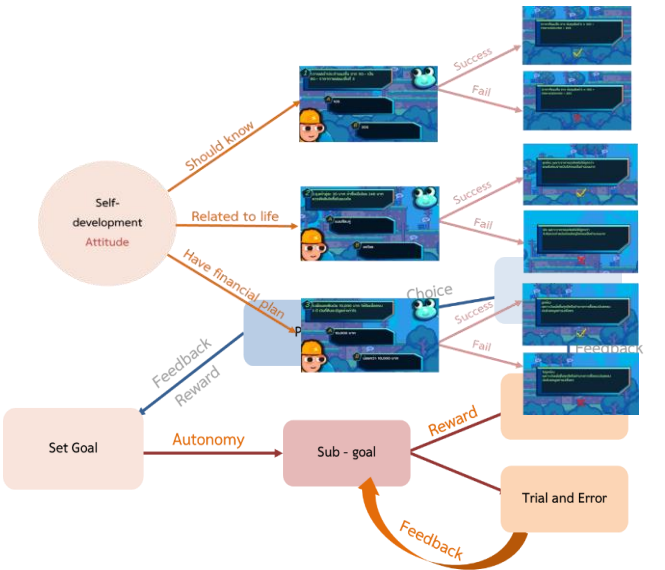


Fig. 4. "Self-development" diagram

The financial game called "Naichangaom" (in the Thai language is a Thrifty Electrician) facilitates the learning process that can lead to financial well-being is depicted in Figure 5.

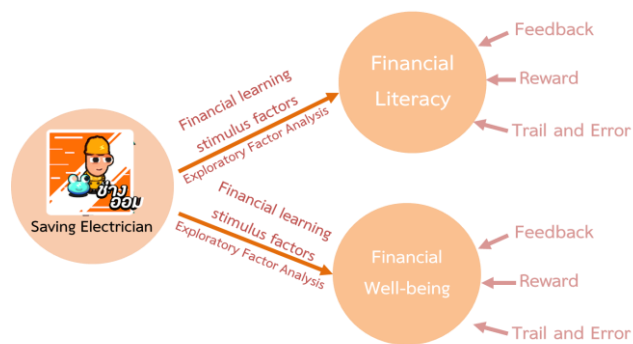


Fig. 5. The financial learning process diagram of "Naichangaom" (Thrifty Electrician)

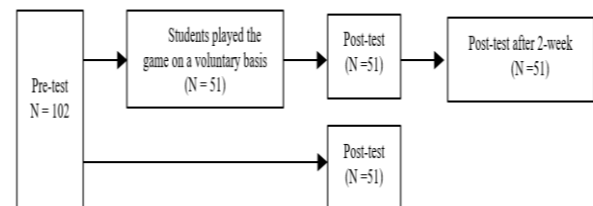
The game was designed to be quiz-based (easy-to-understand questions) with two choices of answer. There are three playing domains: expenditure planning, savings and earning, and investment and risk management. The financial knowledge questions are adapted from the Bank of Thailand's financial literacy questionnaire (2016), which is in line with the OECD standard questionnaire (Bank of Thailand, 2016). The consumer's financial knowledge survey covers the topics of savings, credit, mortgages, and general financial management based on Federal Reserve commissioned (Hogarth & Hilgert, 2002). The test questions also include financial behavior, financial attitude, and financial well-being. The question's arrangement follows PISA 2021 Financial Literacy Analytical and Assessment Framework (OECD, 2019). After the response, immediate feedback for each player's choice is given.

4.3 Testing the Game Effectiveness

4.3.1 Experimental setting

The innovative financial game's effectiveness is measured by an increase in financial literacy by the game players. One hundred two students who use the mobile phone with the Android operating system participated in the experiment. Fifty-one students are in the experimental group, and the remaining fifty-one are in the control group. The game effectiveness was conducted in three steps, as illustrated in Figure 6. A short pre-test questionnaire was administered to the experimental group before playing the game, immediately after playing the game, and 2-week after the experiment. The researcher introduced

the game "Naichangaom" (Thrifty Electrician) to the experimental group with two hours for



playing. In the meantime, the control group answered the short pre-test and post-test questionnaires.

Fig. 6. Experimental setting

4.3.2 Participant's information

The demographic information of 102 participants. The samples are all males between 16 and 17 years old, 91% have a personal income lower than 10,000THB per month, and 83.3% have a household income below 80,000THB per month. Among all 102 sample students, only 22.5% of them reported having no household debt. When asked about the prospect of having dependents, 59.8% foresee themselves having three or more dependents in the next ten years.

As for the short-term financial goals, 41 from 102 samples (40.1%) responded that they wanted to have some savings for an emergency fund. 43 (42.1%) wanted money for consumption or traveling. 13 (12.7%) wanted money to be independent of their families. 4 (3.9%) wanted money to pay off personal debt or families' debt. Only one person (0.9%) had no short-term financial goal.

53 of 102 students (51.9%) wanted to have significant savings for the long-term financial goal. 9 (8.8%) wanted to buy a car. 19 (18.6%) wanted to buy a property. 9 (8.8%) wanted to start a family, 3 (2.9%) wanted the fund for higher education, 2 (1.9%) wanted to clear the debt. 3 (2.9%) reported having no long-term financial goal. Many had more than one long-term financial goal.

4.3.3 Analysis of the Financial Literacy Score

This section discusses the results of the financial literacy scores obtained from the sample. The

framework to assess financial literacy consists of financial knowledge, attitude, behavior, and financial well-being, as illustrated in Figure 7.

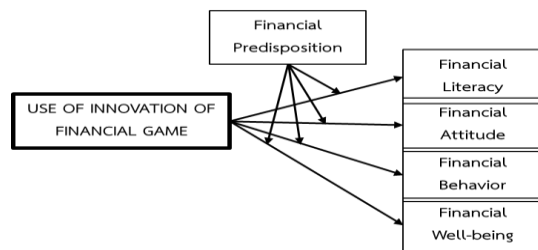


Fig. 7. A framework of the assessment of Financial Literacy and Well-being

1) The experimental group test result

Table 5 shows the experimental group's average test score out of 35 questions in the test's financial knowledge part. Before game playing, the average pre-test score stood at 21.62 ($n=51$), while the scores after playing and after two-week of game playing rose to 25.16 ($n=51$) and 26.23 ($n=43$), respectively. That is, after playing the game, the players' scores increased from 62.74% (before game-playing) to 72.91% (after game-playing) and 74.94% (after two-weeks of game playing). There is a shift of score range from 10-28 (before game-playing) to 13-31 (after game-playing) and 16-32 (after two-weeks of game playing).

Table 5. Financial knowledge score of the experimental group

Financial skills & Well-being	Test time	Mean (S.D.)	No. of students in Experimental group	Std. Error Mean
Knowledge	Pre-test (before, b)	21.62 (4.03)	51	.57
	Post-test (after, a)	25.16 (4.07)	51	.57
	Post two-week (after2w, a2w)	26.23 (3.83)	43	.82

Table 6 reports the pre-test and post-test score differences in financial knowledge, attitude, behavior, and well-being. The knowledge score significantly increases after game-playing ($t(b,a)=5.20$, $p=.000$) and after two-weeks of game-playing ($t(b,a2w)=5.28$, $p=.000$). It appears that the innovative financial game

"NaiChangaom" can increase the financial knowledge of the experimental student group.

In terms of financial attitude, the test shows no significant difference between before and after game playing. Nevertheless, there is a significant difference between before and after two-weeks.

As for financial behavior, the t-test statistics ($t(b,a)=4.668$, $p=.000$) indicates that, after game-playing, players consider themselves having better economic activities than before playing the game. However, the statistical difference diminishes after two weeks ($t(b,a2w)=2.01$, $p=.05$). Game players seem to have greater confidence in making financial decisions and management immediately after playing the game, but their behaviors remain unchanged over time.

The result of financial well-being is similar to that of financial knowledge. Students perceived having better financial well-being after playing the game and two-week after. The game seems to support the financial well-being of the experimental group.

Financial skills	Comparison	Paired Differences			t	df	Sig. (2-tailed)
		Mean (S.D.)	95% Confidence Interval of the Difference				
			Lower	Upper			
Knowledge	Posttest – Pretest (n=51)	3.53 (4.88)	2.17	4.89	5.20	50	.00*
	Posttest 2 weeks – Posttest (n=43)	0.86 (2.54)	0.78	1.64	2.22	42	.32
	Posttest 2 weeks – Pretest (n=43)	4.27 (5.02)	2.73	5.83	5.58	42	.00*
Attitude	Posttest – Pretest (n=51)	-0.026 (0.81)	-.25	.20	0.22	50	.82
	Posttest 2 weeks – Posttest (n=43)	0.45 (1.13)	.10	.79	2.60	42	.13
	Posttest 2 weeks – Pretest (n=43)	0.39 (1.08)	0.06	0.73	2.41	42	.02*
Behavior	Posttest – Pretest (n=51)	0.32 (0.50)	.18	.46	4.66	50	.00*
	Posttest 2 weeks – Posttest (n=43)	-0.50 (0.56)	-.67	-.32	5.82	42	.00*
	Posttest 2 weeks – Pretest (n=43)	0.19 (0.62)	0.38	0.00	2.01	42	.05*
Well-being	Posttest – Pretest (n=51)	0.34 (0.63)	.16	.51	3.87	50	.00*
	Posttest 2 weeks – Posttest (n=43)	-0.86 (0.71)	-.30	1.35	7.9	42	.44
	Posttest 2 weeks – Pretest (n=43)	0.26 (0.83)	0.00	0.51	2.03	42	.05*

Table 6. T-Test Analyses of the Financial Skills within the Experimental Group*2) The experimental versus the control group test result*

Table 7 reveals that the average scores of the experimental group after the game playing are higher than those of the control group in all studied aspects: knowledge, attitude, behaviour, and well-being.

The experimental group's points of financial knowledge are 12.09 better than that of the control group, with the statistic significant at 0.5 level (t -knowledge=16.60, p =.000).

The analysis of the financial attitude and behavior between experimental and control groups reveals no difference between the experimental group and control group with statistical

significance (t -attitude=1.58, p =.120; t -behavior=.60, p =.548). As for financial well-being, the statistical differences at the .05 significance level indicate that after game playing, they considered themselves better at financial well-being than those without game-playing (t -well-being=2.04, p =.047).

In other words, through the use of the innovative game "Naichangaom" (Thrifty electrician), financial literacy was higher among the experimental group than the control group. However, there were no statistically significant differences in attitude and behaviors.

Table 7. T-Test Financial Literacy & Well-being: Experimental versus Control

Financial Literacy & Well-being	Mean (SD) Exper., Control	Means Diff	Std. Error	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Knowledge	25.16 (4.07), 13.07 (4.08)	12.07(5.19)	.732	10.62	13.53	16.60	50	.000
Attitude	2.77 (1.19), 2.44(0.76)	.33(1.50)	.210	-.09	.75	1.58	50	.120
Behavior	4.03(0.56), 3.97(0.55)	.06(0.10)	.103	-.14	.27	.60	50	.548
Well-being	4.17(0.72), 3.92(0.66)	.25(0.12)	.124	.00	.50	2.04	50	.047

The analysis of game acceptance reveals that the experimental group was positive towards adopting the innovative financial game because it makes learning finance topic easy, instigates knowledge, and seeks to learn more knowledge.

Conclusions and Limitation

Financial illiteracy can be explained by the educational process's failure to link the learning goals with learners' personal goals. The literature review also affirms that the financial contents are incompatible with learners' real-life situations. The lack of instant learning feedback prevents the digital-age students from attention retention. With the fact that Gen-Zers are the future economic driving force, financial literacy is required for their proper financial decision and practice, which can lead to the financial well-being of both themselves and the society as a whole (Kerlyl et al., 2006). Through game-based learning, the traditional financial educational can become more

exciting and entertaining so that learners are more motivated and gain more knowledge (El Mawas et al., 2019; Papadakis et al., 2020b). In order to promote financial literacy among this sampling frame, the interactive quiz-based game application is adopted as an innovative financial learning tool.

The empirical study found motivating factors among generation Z students to adopt and engage in the innovative game affirms two main factors: the needs for achievement and financial skills which were utilized for game design. The innovative financial game was developed to allow players to set their own financial goals before entering the game to solve the financial questions related to their real-life situations, earn money, and achieve their financial goals. Besides, the game is designed to provide immediate feedback to players so that they can memorize, understand, and apply the financial concepts for their future financial decision-making in the future.

The experimental group's test results, before, after, and after two-week of game playing, reveals that the game can increase their financial knowledge, attitude, behavior, and well-being. The test result comparison between the two studied groups also affirms that the experimental group had better financial knowledge than the control group. At the same time, there were no statistically significant differences in financial well-being, attitudes, and behaviors.

Suggestions for further studies are to apply the findings from this innovative financial game research on other aspects of financial literacy, such as knowledge about investment, debt management, consumer protection, etc., which are all necessary for an individual's financial well-being. Aside from starting with factors like learning motivation for goal-setting and self-improvement needs with eight sub-topics to enhance financial literacy and well-being, other digital media developers can further design and develop alternative game features in the applications.

Also worth taking into account, samples of this research were collected from the PEAES electrician students who studied at the vocational level or the equivalent of a high school level. Therefore, the complexity of questions in the game was designed to suit their knowledge level and real-life scenario. Besides, the study was conducted within a short time. Hence, future studies will be of interest to lengthen the experimental research time frame and to fine-tune the questions used in the financial game. The game can also be enhanced in features such as game mechanics to attract more attention from users.

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