Application of Fuzzy Delphi Method for Evaluating and Validating Gamification Learning Framework for Language Learning

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ABSTRACT

This research aims to reach expert consensus and alignment regarding the validation of Gamification Learning Framework for Language Learning. This research employed two iterations of the Fuzzy Delphi Method (FDM) with a 7-point agreement scale to gather assessments from 20 experts across various fields, including technology, gamification, education, TESL, adult learning, mobile learning, communication, CALL, management, digital transformation, curriculum design, game creation, cybersecurity, and system architecture. The research instrument consists of 51 items, developed from two prior studies involving mixed methods and a systematic literature review. The data examined utilizing Triangular Fuzzy Number and the Defuzzification Process. The findings indicate that experts achieved consensus on 51 items in Round 1, and in Round 2, 50 of the 51 items received agreement from experts, and 44 out of 51 items received Threshold (d) values under 0.2. The research indicated that the consensus and agreement among experts exceeded 75% for majority of the elements, with a Threshold (d) value under 0.2 (d = < 0.2). The 44 items in the survey that met the Triangular Fuzzy Number requirements therefore received approval, while 7 items were rejected. This finding suggested that 44 items have achieved expert agreement and are therefore validated as essential elements and constructs in the gamification learning framework in language learning. FDM can incorporate specialized viewpoints to achieve agreement on validating the constructs, guaranteeing dependability and significance of the created items.

Keywords: Framework, Fuzzy Delphi, Gamification, Language Learning, Technology Learning

Contribution/Originality: This study contributes to the existing literature by validating the newly developed Gamification Learning Framework for Language Learning (GLF-LL) using expert consensus and the Fuzzy Delphi Method. It offers a new approach to gamifying language learning and helps design future educational frameworks.

INTRODUCTION

The ongoing digital revolution disrupts education and is similar to generative artificial intelligence (A.I.). In 2023, many online advanced A.I. applications, such as social media and various websites, contribute to disrupting the educational process for students. This disturbance "arose from the rapid pace of technology and the quick uptake of new technology to facilitate it" (Fisk, 2017). Additionally, it has been proposed that each new technological innovation will give rise to disruptive technology (Conole, 2016; Christensen, 1997). Colleges and universities must adapt their strategies and practices in providing education to stay aligned with the needs of students. Indeed, educational reform has occurred numerous times worldwide because of innovations.

A study by Smirdele (2020) outlined the effects of gamification on students' learning outcomes, selfengagement, and behaviors, informed by students' unique personality traits. The study demonstrated that gamification has a significantly positive effect on enhancing students' awareness of tasks. The study's diverse sample includes introverted and extroverted students, revealing greater engagement from introverted students compared to their extroverted counterparts. These findings, however, indicated that a more extensive and longterm study is needed to assess the impact of gamification on student behavior over an extended timeframe. The experimental research conducted by Smirdele (2020) is analogous to that of Chen and Liang (2022), whose study focuses more on how

gamification affects students' self-efficacy. Self-efficacy reflects students' views and beliefs regarding their capacity to independently accomplish learning tasks. Historically recognized as students' confidence in completing a task, Chen and Liang (2022) proposed that incorporating gamification in education enhances self-efficacy and enjoyment, which can have a positive impact on students' study engagement.

In gamified education, the main role of gamification is to transform learning from tedious and dull to thrilling and lively. Every teacher aspires for their classes to be dynamic and engaging, populated by students who are highly involved in participation. Nonetheless, accomplishing that goal is not simple. The development of a gamification learning framework is crucial in transforming education, enhancing the engagement of learning, and encouraging teachers to be more proactive in their instruction.

Research Objectives

1. To investigate the agreement of experts on the constructs of the Gamification Learning Framework for Language Learning (GLF-LL) after round 1 of Fuzzy Delphi.
2. To examine the level of validation of experts on the Gamification Learning Framework for Language Learning after round 2 of Fuzzy Delphi.

Research Questions

1. What is the level of validation of experts on the Gamification Learning Framework for Language Learning (GLF-LL) after round 2 of Fuzzy Delphi?
2. What is the agreement of experts on the constructs of the Gamification Learning Framework for Language Learning (GLF-LL) after round 1 of Fuzzy Delphi?

LITERATURE REVIEW

Gamification is a recent trend that applies to aspects of non-gaming environments to boost user engagement or audience motivation. As per Adkins (2019), his latest report on the status of the game learning market indicates that the growth rate for games in the tertiary sector and higher education is 15.4%. The extensive implementation of gamification software has facilitated the application of gamification in the educational field (Lynkova, 2019). Numerous studies have shown that gamification can transform the learning experience from conventional and physical settings to a virtual-mixed mode environment. Gamification offers advantages not only in a single area, but its use has led to significant transformations across various sectors, including business, healthcare, science, and specifically in this study, education.

As gamification is represented mostly by game elements, these micro game-attributed characters have been widely used and researched (Deterding et al., 2011). Points, badges, levels, leaderboards, avatars, challenges, quests, feedback, progress bars, skills mastery and many more are found to enhance motivation of students especially through hidden rewards and recognitions such as badges and experience in game (Deterding, 2012; Yechkalo et al., 2024; Lutfi, A., Aftinia, F., & Permani, B. E. (2023)). Helping visualize learning progress through visible icons, these elements encourage persistence and assist in building individual pathways to learning.

Current research on gamification in language learning highlights the effect of it on learner motivation and engagement. There is evidence that gamified learning establishes a form of language acquisition far removed from the traditional approach, often tiring and monotonous. For instance, a systematic literature review on studies between 2017 and 2024 reported that gamification increases motivation, encourages involvement and supports the autonomy of participants while learning (Oazizi, et. al., 2024). Game components, notably points, badges and leaderboards have been associated with enhanced vocabulary retention and grammatical accuracy because of the instantaneous feedback and reinforcements provided in real-time towards keeping learners motivated (Fatah, 2025). In addition, the incorporation of avatars and interactive tasks can increase learner engagement for the learning as they make such a process more customized and visually appealing (Nasir, et. al., 2026).

Besides motivation, gamification has been found to affect other important parts of language learning such as learner interaction and continuous participation. For example, studies show that gamification increased willingness and active participation in language practice of students under cooperative conditions (Adzmi, et. al., 2024). Adaptive learning features within gamified environments have also been researched, with studies demonstrating that personalized learning paths depending on learners' level of progression improve language

acquisition more (Plooy, et. al., 2024). However, is there a problem with longer-term effectiveness of the gamification. Some critics argue that the novelty effect may wane over time, and if gameplay and game design are not constantly updated to maintain interest, a power law of decay occurs. In addition, though gamification has obvious advantages, its implementation is bound to be accrued with bolstered learning and situated context (Gini,et. al., 2025). From these gaps, the researcher formulate the above focused questions for the study to further attest the practical impact of the Gamification Learning Framework for Language Learning (GLF-LL) in improving motivational and academic performances of tertiary level students.

RESEARCH METHODS

This research was performed at the University Poly-Tech Malaysia (UPTM), a private university in Malaysia. The decision to carry out the study in UPTM as opposed to any other part of the city is because it is convenient for the researcher, as well as UPTM is private university in Kuala Lumpur, a center for academic and technological development. Since this research is intended for the development of a learning framework that incorporates gamification, the educational environment of the university and its focus on technology integration make it a suitable place for getting insights from professionals in education and IT sectors.

The study population consists of experts and academicians. In overall, there are 20 experts; 18 Ph.D. holders and 2 Master's Degree holders participated in this study. These experts were chosen because of their background and experience in academics in tertiary level including education, technology and gamification and have the related knowledge necessary to make valuable comments on how this gamification framework could be developed. The sample was split into 2 groups: the original panel of 10 experts (Round 1) were selected internally from UPTM, while the group of 10 external experts (round 2) came from outside university and brought a variety of views. Academics and game developers with substantial previous experience in both educational technology as well as the field of gamification.

For this study, a convenience sampling method was employed. This method was chosen because the experts were readily available and accessible, and they had the necessary experience and qualifications to provide meaningful contributions.

This research is using quantitative logic and utilizes the Fuzzy Delphi Method (FDM) to reach expert agreement on the components of the gamification learning framework. In this study, the traditional Delphi is modified by integrating the fuzzy-set-theory, with selected Likert-scale from experts to get an alternate score measurement using fuzzy numbers made by binary terms (0 and 1). Through the incorporation of fuzzy numbers, the output produced three different values including lowest value, most suitable value, and highest value which experts have chosen.

Instrument

Prior to the development of instrument for this expert evaluation, this research used a mixed-method design and employed quantitative and qualitative data collection methods. The methodology was designed under the ADDIE model (Analysis, Design, Development, Implementation and Evaluation) orienting the development process. During the Analysis stage, a survey was used to gather quantitative data, while semi-structured interviews were conducted to collect qualitative insights from the participants. These instrument which consist of survey and semi-structured interview questions, have been piloted, expert-reviewed and revised with face and content validation checks from language experts and curriculum specialists. Then in the Design phase, a Systematic Literature Review (SLR) was performed to gather existing research and best practices related to gamification, which informed the design of the framework. The systematic literature review aims to gather contemporary literature and previous research's findings on the underpinning theories related to gamification learning, most used micro gamification elements, and how to design gamification-based applications or websites.

The findings from both prior studies are later combined and used to develop the questionnaire for the experts during the evaluation of Fuzzy Delphi Method. The questionnaire is used to satisfy the conditions and the needs of the proper application of Fuzzy Delphi Method (FDM), which applies mathematical procedures in reaching expert consensus.

As an instrument to obtain quantitative data regarding the constructs for the gamification learning framework for language learning, this particular stage of study uses a questionnaire as the main instrument. The

questionnaire employed in the Development stage was created based on results from previous phases, which encompasses SLR as well as the mixed-methods data from the Analysis stage. Furthermore, a second cycle of mixed methods were then used to test the framework which will take place during Implementation and Evaluation stage. This involved survey and focus group discussions as well as a design review of the framework. This enabled the investigators to improve the model and provide evidence of its validity, but also of its reliability.

Data Analysis Procedure

The data collection and analysis process in this study refers to FDM application phases as follows:

Step 1: Selection of Experts & Experts Profile

The first step of Fuzzy Delphi Method (FDM) was utilized by this researcher in this study by selecting a panel of experts who consented to share their knowledge through offering suggestions, evaluating, and enhancing the items specified by the researcher. Table 1 depicts the selection process of the experts during both rounds of the evaluation process.

Table 1: Experts Selection Criteria

Evaluation Rounds	Experts' Criteria
Round 1	Must be from inside the learning institutions
	More than 5 years' experience in the field of technology or related to gamification / or
	Have academic or industrial experience in dealing with gamification field (creating applications, conduct study, used application or game-based web)
Round 2	Must be from the outside of the learning institutions
	More than 5 years' experience in the field of technology or related to gamification / or
	Have academic or industrial experience in dealing with gamification field (creating applications, conduct study, used application or game-based web)

Readiness is crucial to guarantee that the specialists are truly eager to support the researcher and have adequate time to engage in the research. A total of 20 specialists were selected to assess and validate the gamification learning framework for language learning. All 20 experts consented to collaborate, invested their time, and voluntarily helped to the success of this research.

Table 2: Experts' Profile

Code	Experts Qualification	Field of Expertise	Years of Experience
E101	PhD in Computer Science	Artificial Intelligence	20+
E102	PhD in Information Communication Technology	Gamification, Game Design, Game Based Education	20+
E103	PhD in Computer Science	M-Learning, e-Learning	20+
E104	PhD in Computer Science	Digital Education, Mobile Learning, Adult Learners, Andragogy	20+
E105	PhD in Communication	Technology in Communication	15 – 20
E106	PhD in Education (TESL)	English as Medium of Instruction (EMI)	20+
E107	PhD in Education (TESL)	Technology Enhanced Language Learning (TELL)	15 – 20

E108	PhD in Education (TESL)	Education for Sustainable Development (ESD), Education	20+
E109	PhD in Education	Computer Assisted Language Learning (CALL)	20+
E110	PhD in Management	Management Techniques, IT for Management, UX Management	15 – 20
E201	PhD in Operations Management	Digitalization, Strategic Management, IT Strategy, SME	20+
E202	PhD in Education	Educational Technology, Technology-Enhanced Language Learning, Technoloy Acceptance Models, ESL, Flipped Learning, Online Learning	20+
E203	Master's in System Architecture	System Architecture, Computer Networks and Security	20+
E204	PhD in Creative Multimedia	Communication, Media & Technology Education	20+
E205	PhD in Information Technology	Cryptography, Information Hiding, Information Security, Biometric, Deep-Learning in Image Processing, Cybersecurity, Gamification and Simulation, Extended Reality, Interaction Design, Internet of Things	20+
E206	PhD in Educational Technology	Educational Technology, Game-Based Learning, Gamification, Learning Analytics	20+
E207	Diploma in Computer Science	Game Developer, Todak Academy Animation advisor	20+
E208	PhD Theoretical linguistic	ESL, Curriculum implementation and Evaluation, Bilingualism, educational Management	20+
E209	PhD in Computing	Human Computer Interaction	15 – 20
E210	PhD in Education	TESL, Educational Technology	20+

Although there is no strict rule for the number of experts required in Delphi studies, many methodological sources indicate that panels of 10–20 or up to 30 experts are acceptable if the experts are carefully selected and highly qualified (Rowe & Wright, 2001; Okoli & Pawlowski, 2004; Shang et al., 2023; Giannarou & Zervas, 2014). As Sever (2021) cited from Okoli & Pawlowski (2004) that a homogeneous group of experts consists of 10 to 15 individuals, which is the minimal sample size are needed for the reliability and validity of experts' evaluation. Similarly, Rowe and Wright (2001) stated that Delphi groups could include 5-20 experts to represent the homogeneity of the population. Table 2 presents the profiles of the experts participating in this study throughout both rounds of the evaluation.

Step 2: Questionnaire Creation for Experts

The construction of the questionnaire can be done through two methods, namely interviews and literature review. The Delphi method is also one of the most flexible methods to attain an expert consensus (Powell, 2003). This is because in the first round Delphi experts are interviewed to find out a problem. Although, openended questions can also help identify an issue and get that issue. Literature review is another way of obtaining similar concerns by means of questionnaires, as reviewed by Mastam et. al. (2024) which stems from the findings of Duffield (1993). In designing and developing gamification learning framework for language learning, the groundwork of the study is established from a systematic literature review in design analysis phase and mixed method approach consist of survey and expert interview in the needs analysis phase. Hence, in total 51 items within the six constructs have been generated for the questionnaire to design and develop the gamification learning framework for language learning.

Step 3: Distribution of Evaluation Form

The distribution of evaluation forms to experts is done through e-mail. In minor case, some experts who requested a face-to-face meeting will be met online through Zoom online meeting. The experts from Round 1

are given 2 weeks to complete the evaluation. After data collection process is completed for Round 1, researchers spent 7 days to complete the analysis and rewrite the questionnaire based on the findings from Round 1. Then, the researcher proceeded with evaluation for Round 2. The experts from Round 2 are given 2 weeks to complete the evaluation as well. After data collection process is completed for Round 2, researcher proceeded with the complete analysis and wrote the findings.

Step 4: Coding Process

This work encompasses translating all linguistic variable scales as Triangular Fuzzy Numbers. Triangular Fuzzy Numbers are represented with the values $m1$, $m2$, and $m3$. Here, $m1$ indicates the lowest value, $m2$ denotes the most plausible value, and $m3$ signifies the highest value. Next, Triangular Fuzzy Numbers are used to develop a Fuzzy scale that uses a Likert scale to transform linguistic variables into Fuzzy numbers. The count of levels on the Fuzzy scale is uneven. The larger Fuzzy scale results in a more accurate information acquired. The minimum triangle graph is in direct relationship with the Triangular value, covering all the three values of the Triangular Fuzzy Number as shown in Figure 1.

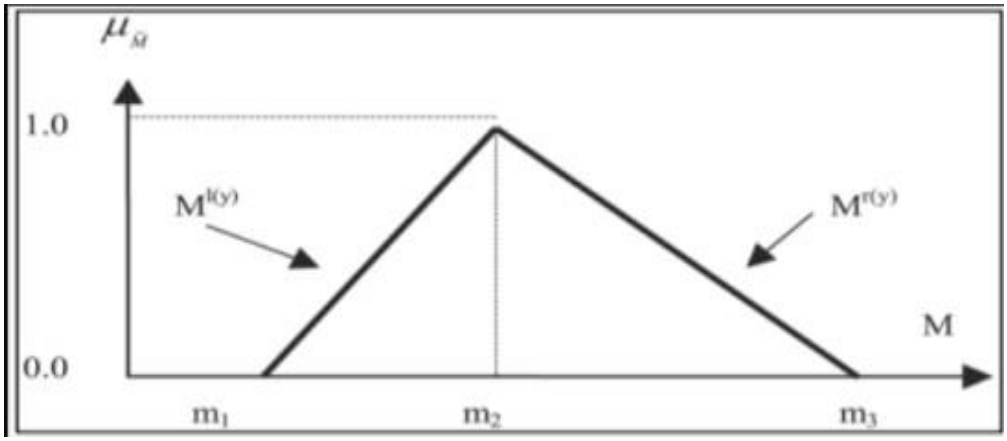

Figure 1: Minimum triangle chart versus triangular. Adapted from Jamil, M. R. M. & Noh, N. M. (2020)

Figure 1 illustrates the Triangular to minimum triangle graph with $m1$=lowest value, $m2$=medium value, and $m3$=maximum value. The data were processed with Microsoft Excel 2013. All the data we transferred to Triangular Fuzzy Number format for analysis. For this study, all questions were designed using a seven-point Likert Scale. Therefore, Table 3 depicts the linguistic variable of the fuzzy scale.

Table 3: Configuration of Fuzzy Scale with Likert-Scale and Preferential Scale

Likert Scale	Fuzzy Scale	Preferential Scale
1	(0.0, 0.0, 0.1)	Completely Disagree
2	(0.0, 0.1, 0.3)	Strongly Disagree
3	(0.1, 0.3, 0.5)	Disagree
4	(0.3, 0.5, 0.7)	Neutral
5	(0.5, 0.7, 0.9)	Agree
6	(0.7, 0.9, 1.0)	Strongly Agree
7	(0.9, 1.0, 1.0)	Completely Agree

Step 5: Data Analysis

The data analysis is based on the evaluation of Triangular Fuzzy Numbers to obtain the Threshold values of (d). Based on the report of Thomaidis et al. (2006), determining the value of Threshold (d) is essential in obtaining expert agreement. In reaching conclusive agreement for each item among all experts involved in the study, the primary condition that needs to be fulfilled is that the Threshold (d) value must be less than 0.2, signifying that expert consensus has been attained (Cheng & Lin, 2002). In fuzzy logic, the vertex method calculates the average

distance between two scores. However, although Cheng and Lin (2002) suggested to remove items with low commonalities, Costello & Osborne (2005) also suggest that the strictness of 0.2 is not a hard cutoff, translating to the selection of items with Threshold (d) value of more than 0.2 should be adjusted based on context, sample size and study goals. The distance for each Fuzzy value m = ($m1$, $m2$, $m3$) and n = ($m1$, $m2$, $m3$) is determined through the following formula, as depicted in Figure 2 below;

$$(\tilde{m},\tilde{n})=\sqrt{13}[(m1-n1)2+(m2-n2)2+(m3-n3)2]$$

Figure 2: Triangular Fuzzy Number calculation formula

Step 6: Achieving Experts' Consensus Percentage

The second criterion that should be met to have an estimation of percentage value of expert consensus is that mean group % agreement needs to exceed 75% in each item. In the case that this condition is not met, a second round must be carried out (Chu & Hwang, 2008; Murray et al., 1985). For this study, researchers found that out of 51 items, 5 items failed to meet the minimum surpass percentage therefore proceeded with another round of evaluation.

Data Analysis using Average Fuzzy Number (Defuzzification)

The final stage in the fuzzy logic system is the Defuzzification process. Defuzzification involves converting fuzzy numbers, which indicate uncertainty or ambiguity into a clear and exact value. In this study, the researcher chose to use the Sugeno method to determine each element's Weighted Average value, which are later calculated for precise and crisp value to determine the defuzzified result.

RESULTS

In this gamification learning framework for language learning constructs, the items given to the experts are particularly categorized into 6 different constructs and are stated in Table 4 below.

Table 4: Constructs of the Gamification Learning Framework for Language Learning

Constructs	Elements	Details of Constructs
Game Elements / Game Construct	Points, Level, Badges, Leaderboards, Title, Challenges, Progress Bar, Avatar, Quest, Skills Mastery, Feedback, Collaboration, Return visit Points, Narrative, Time-Attack Challenge, Role-Playing Quest	Micro game elements representing gamification elements
Gamification Categories	Engagement Rate, Completion Rate, Proficiency Rate, Feedback, Collaboration, Time-on Platform	Relationship of micro game elements and foundation of teaching and learning, divided into 6 pillars or category of gamification
The Underpinning Model / Approaches / Theories	Self Determination Theory (Deci, Ryan 2000), Constructivist Learning Theory (Piaget, 1977), Second Language Acquisition (SLA) (Vygotsky, 1978), Socio Cultural Theory (Vygotsky, 1978), Behaviorist Theory (Skinner, 1957), Flexible Learning Theory (Müller & Mildenberger, 2021)	Base of the framework from theoretical perspective, gathered from systematic literature review
Design Elements	Scalability, Flexibility, Usability, Accessibility, Social Interactivity, Feedback, Ethical Consideration	Guidelines to use this framework to design gamification-related applications, websites or products

The Framework as a Guidelines	Align with SDG 4, Assist in pedagogy of teaching and learning, Reduce stress, Guide users about how gamification is different from conventional class, Assist in transforming education, Provide information about how gamification increase motivation, Promote collaboration and autonomy, Ensure learners have the best opportunity to learn language, Balance time and resources	To be used as reference if users want to use the framework as Guidelines
Insights for the Framework	The focus should be on the execution of the lesson through gamification, The game elements have higher influence on efforts of students, Progress bar will enable students to be more aware of their completion rate, Feedback from instructors is vital, Anyone who like to use this framework must have experience in game, The framework must be peer-reviewed after completed, This framework provide structure to design products within the area of gamification in education	The insights of the framework

The threshold value (d), percentage of experts consensus (%), defuzzification process with itemized m values and order of item with its' ranking within the specific construct for the above items are shown in Table 5.

Table 5: Fuzzy Delphi analysis on the constructs of gamification learning framework for language learning

No	Items / Elements	Triangular Fuzzy Numbers		Fuzzy Evaluation Process				Experts CONSENSUS	Element ACCEPTED	Rank
		Threshold Value, d	Percentage of Experts Consensus, %	m1	m2	m3	Fuzzy Score (A)			
CONSTRUCT 1: GAME ELEMENTS / GAME CONSTRUCT										
1	Points	0.049	100.0%	0.860	0.980	1.000	0.947	ACCEPTED	0.947	1
2	Level	0.128	100.0%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	6
3	Badges	0.128	100.0%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	6
4	Leaderboards	0.258	90.00%	0.650	0.810	0.910	0.790	ACCEPTED	0.790	15
5	Title	0.258	90.00%	0.650	0.810	0.910	0.790	ACCEPTED	0.790	15
6	Challenges	0.103	90.00%	0.800	0.940	0.990	0.910	ACCEPTED	0.910	4
7	Progress Bar	0.064	100.00%	0.840	0.970	1.000	0.937	ACCEPTED	0.937	2
8	Avatar	0.243	90.00%	0.670	0.830	0.920	0.807	ACCEPTED	0.807	14
9	Quest	0.145	100.00%	0.720	0.880	0.970	0.857	ACCEPTED	0.857	11
10	Skills Mastery	0.137	90.00%	0.760	0.910	0.970	0.880	ACCEPTED	0.880	9
11	Feedback	0.098	90.00%	0.820	0.950	0.990	0.920	ACCEPTED	0.920	3
12	Collaboration	0.103	90.00%	0.800	0.940	0.990	0.910	ACCEPTED	0.910	5
13	Return visit Points	0.203	90.00%	0.680	0.840	0.940	0.820	ACCEPTED	0.820	12
14	Narrative	0.128	100.00%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	6
15	Time-attack Challenges	0.107	100.00%	0.720	0.890	0.980	0.863	ACCEPTED	0.863	10
16	Role-Playing Quest	0.145	100.00%	0.660	0.840	0.960	0.820	ACCEPTED	0.820	12
CONSTRUCT 2: GAMIFICATION CATEGORIES										
1	Engagement Rate	0.259	90.0%	0.730	0.860	0.920	0.837	ACCEPTED	0.837	5
2	Completion Rate	0.064	100.0%	0.840	0.970	1.000	0.937	ACCEPTED	0.937	1
3	Proficiency Rate	0.181	90.0%	0.740	0.890	0.950	0.860	ACCEPTED	0.860	4
4	Feedback	0.076	100.00%	0.800	0.950	1.000	0.917	ACCEPTED	0.917	2
5	Collaboration	0.101	100.00%	0.780	0.930	0.990	0.900	ACCEPTED	0.900	3
6	Time-on-Platform	0.218	90.00%	0.660	0.830	0.930	0.807	ACCEPTED	0.807	6

CONSTRUCT 3: THE UNDERPINNING MODEL / APPROACHES / THEORIES										
1	Self Determination Theory	0.103	90.0%	0.800	0.940	0.990	0.910	ACCEPTED	0.910	3
2	Constructivist Learning Theory	0.064	100.0%	0.840	0.970	1.000	0.937	ACCEPTED	0.937	1
3	Second Language Acquisition (SLA)	0.101	100.0%	0.780	0.930	0.990	0.900	ACCEPTED	0.900	4
4	Socio Cultural Theory	0.129	90.00%	0.740	0.900	0.970	0.870	ACCEPTED	0.870	6
5	Behaviorist Theory	0.094	100.00%	0.760	0.920	0.990	0.890	ACCEPTED	0.890	5
6	Flexible Learning Theory	0.073	100.00%	0.820	0.960	1.000	0.927	ACCEPTED	0.927	2
CONSTRUCT 4: DESIGN ELEMENTS										
7	Scalability	0.128	100.0%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	7
10	Flexibility	0.000	100.0%	0.900	1.000	1.000	0.967	ACCEPTED	0.967	1
11	Usability	0.087	90.0%	0.840	0.960	0.990	0.930	ACCEPTED	0.930	6
12	Accessibility	0.027	100.00%	0.880	0.990	1.000	0.957	ACCEPTED	0.957	2
7	Social Interactivity	0.064	100.00%	0.840	0.970	1.000	0.937	ACCEPTED	0.937	5
6	Feedback	0.027	100.00%	0.880	0.990	1.000	0.957	ACCEPTED	0.957	2
7	Ethical Consideration	0.070	90.00%	0.860	0.970	0.990	0.940	ACCEPTED	0.940	4
CONSTRUCT 5: THE FRAMEWORK AS A GUIDELINES										
1	Align with the Sustainable Developmental Goals	0.103	90.0%	0.800	0.940	0.990	0.910	ACCEPTED	0.910	1
2	Assist in the pedagogy of teaching and learning	0.101	100.0%	0.780	0.930	0.990	0.900	ACCEPTED	0.900	2
3	Reduce stress	0.290	80.0%	0.610	0.780	0.890	0.760	ACCEPTED	0.760	9
4	Guide users about how gamification is different from conventional class	0.082	100.00%	0.740	0.910	0.990	0.880	ACCEPTED	0.880	6
5	Assist in transforming education	0.094	100.00%	0.760	0.920	0.990	0.890	ACCEPTED	0.890	3
6	Provide information about how gamification can increase motivation	0.128	100.00%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	4
7	Promote collaboration and autonomy	0.128	100.00%	0.760	0.910	0.980	0.883	ACCEPTED	0.883	4
8	Ensure learners have the best opportunity to learn language	0.185	90.00%	0.700	0.860	0.950	0.837	ACCEPTED	0.837	8
9	Help balance time and resources	0.088	100.00%	0.680	0.870	0.980	0.843	ACCEPTED	0.843	7
CONSTRUCT 6: INSIGHTS FOR THE FRAMEWORK										
8	The focus should be on the execution of the	0.064	100.0%	0.840	0.970	1.000	0.937	ACCEPTED	0.937	1

	lesson through gamification									
9	The game elements have higher influence on efforts of students	0.103	90.0%	0.800	0.940	0.990	0.910	ACCEPTED	0.910	4
10	Progress bar will enable students to be more aware of their completion rate	0.087	90.0%	0.840	0.960	0.990	0.930	ACCEPTED	0.930	2
11	Feedback from instructors is vital	0.166	90.00%	0.740	0.890	0.960	0.863	ACCEPTED	0.863	5
12	Anyone who like to use this framework must have experience in game	0.281	70.00%	0.470	0.640	0.800	0.637	REJECTED	0.637	7
11	The framework must be peer-reviewed after completed	0.098	90.00%	0.820	0.950	0.990	0.920	ACCEPTED	0.920	3
12	This framework provide structure to design products within the area of gamification in education	0.159	90.00%	0.720	0.880	0.960	0.853	ACCEPTED	0.853	6

Condition:

1) Triangular Fuzzy Numbers (Defuzzification Process) = Percentage of Experts Consensus > 75%
2) Threshold Value (d) must be less than 0.2 = (d = < 0.2)

According to the result in Table 5 above, the Thresholds value (d) of 44 out of 51 items was equal or less than 0.2. This result shows that 44 items out of 51 have reached an expert consensus (Cheng & Lin, 2002). Expert agreement also shows that 50 out of 51 items are over 75%. Therefore, the results revealed 44 of the 51 items in the construct of gamification learning framework for language learning have achieved a consensus of experts and thus should be included in developing this framework.

DISCUSSION

The findings from the FDM analysis in this research have generated a set of constructs for creating a gamification learning framework for language acquisition. The preliminary results obtained from FDM demonstrate significant validity and reliability. The results show a strong level of approval, indicating that the utilization of FDM to achieve expert consensus using quantitative methods among respondents is valid. The results also identified items that experts agreed on and ranked for each construct. The findings suggest that 44 of these 51 items need to be included in the design and development of the gamification framework for language learning.

Through this FDM analysis, the prioritization of item arrangement begins with the construct (1) game elements, (2) gamification categories, (3) theoretical underpinnings, (4) design elements, (5) the framework as a guidelines, and (6) insights of the framework. All experts agreed that these attributes assist in building gamification environment for language learning, help teachers and institutions create and conduct gamification-related classes or product, as well as guide the public about the benefits and advantages of gamification and its impact towards 21st century learning. Conventional classes, if conducted with the help of gamification elements, has the ability to boost motivation, increase academic performance as well as suit different types of learners. Students' potential can also expand to unprecedented levels when they are provided with opportunity to embrace learning with different routes of education which is fun and engaging. Moreover, collaborative and individual potential to

solve tasks will be developed even further, given the access to unlock creativity and different ways to think to solve problems are enabled with gamification-enabled environment.

CONCLUSION

In conclusion, this study's objective was able to confirm the constructs required for the validation of the gamification learning framework for language learning (GLF-LL). The FDM analysis that was done throughout the 2 rounds of Fuzzy Delphi analysis (FDM) successfully reached agreement among 20 experts, confirming the consensus and mutual agreement towards 44 items and rejected 7 items from 51 items in the evaluation. This validation is a necessity in the process of creating a framework in the field of language learning and gamification, that is gaining popularity recently. As our nation is moving towards 21st century learning, digitalization of education is becoming a common norm. Therefore, the availability of the gamification learning framework for language learning will provide an impactful perspective for institutions, teachers and students when designing language learning lessons.

In summary, the confirmation of the gamification learning framework for language acquisition via the FDM marks an important advancement in improving academic performance and boosting motivation. Integrating micro gamification features into conventional language classes enhances students' internal and external motivation to succeed in collaborative and performance-based tasks. From the feedback standpoint, immediate rewards and adjustments will be implemented for both teachers and students to enhance learning outcomes moving forward. Incorporating gamification into a learning management system (LMS) transforms the ecosystem in a way that not only changes how LMS is utilized but also modifies the delivery of education to tertiary level students for both this generation and the next. The validation of the gamification learning framework for language acquisition is essential for boosting motivation, facilitating learning with reduced stress, and cultivating an encouraging atmosphere that appreciates various types of learners.

AI-driven analytics may be used to increase this personalization by spotting patterns of learner difficulty and offering targeted supports (Haenlein & Kaplan, 2019). The inclusion of adaptive feedback (e.g., real-time messages, achievement related feedback) may contribute to an even more personalized learning environment and higher learning outcomes (Shute, 2008). The Gamification Learning Framework for Language Learning (GLF-LL) might include such things as text-to-speech functionality, high contrast modes, personalized user interfaces, and adaptive learning paths that adapt to individual progress and user learning styles. Resources such as personal achievement tracking or progression bars, rather than competitive leaderboards that could lead to turbulent and unneeded rivalry, should be introduced to promote an empowering inclusive environment conducive for learning (Vasalou et al., 2008).

Ethics Approval and Consent to Participate

The study was approved by the Research Ethics Committee (REC) of University Teknologi MARA (UiTM), guaranteeing that ethical policies were followed in the conduct of this study. All participants provided written consent, which was obtained via an official letter from Faculty of Education UiTM Shah Alam. This informed consent described the motives for this survey and participants' roles, as well as right to privacy and anonymity.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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