Gamification Learning Environment (GLE) for Supporting Self-Regulated Learning in Arabic Vocabulary: A Quasi-Experimental Study.

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ABSTRACT

The purpose of this research is to see the effects of Gamification Learning Environment (GLE) developed towards students' performance, motivation and the Self-Regulated Learning (SRL) strategies used in learning Arabic vocabulary; and the correlations between motivations, SRL strategies and performance. A quasi-experimental design was employed involving 55 secondary school students from one of the districts in Malaysia. Two online learning environments were developed: a gamified version for the experimental group and a non-gamified version for the control group. Pre and post tests were conducted prior and after the students learning in the online environment for three (3) weeks using Arabic vocabulary test and adapted Motivated Self-regulated Learning Questionnaire (MSLQ). The results indicated that although there was no statistically significant overall difference in performance gains between the two groups, students in the gamified group who initially had lower vocabulary scores demonstrated greater improvement compared to their counterparts. In addition, a strong positive correlation was found between post-intervention motivation and SRL strategies in the experimental group ($r = .745$, $p < .001$), as well as between changes in motivation and changes in SRL strategies ($r = .638$, $p < .001$). However, no significant correlations were observed between motivation or SRL strategies and vocabulary performance in either group. Overall, the findings suggest that while the GLE did not function as a universal performance enhancer, it was particularly effective in supporting lower-performing students and in strengthening the relationship between motivation and self-regulated learning strategies.

Keyword: Gamification, Self-Regulated Learning strategies, Motivation, Arabic language, Foreign language learning.

INTRODUCTION

Over the years, numerous studies have suggested ways to improve the learning environment and help students remain engaged in online learning. Online learning became an unavoidable necessity, imposed regardless of learners' readiness. Institutions that had previously resisted moving away from traditional pedagogical models were left with no choice but to fully embrace online teaching and learning during the pandemic (Dhawan, 2020). This abrupt transition posed significant challenges to education systems worldwide, compelling educators to adopt digital teaching methods almost overnight. Undoubtedly, the student learning environment has changed; however, sustaining engagement and success in an online learning environment is difficult and requires students' awareness and motivation.

Applying Self-Regulated Learning (SRL) strategies could enhance students' cognitive and metacognitive skills, thereby increase their learning awareness and transforming a passive learning attitude into an active one. Despite SRL strategies proven to increase students' academic achievement across subjects (Alotaibi, 2017; Chen, 2009; Seker, 2016) it is difficult to employ and sustain because it demands discipline and high motivation from the students (Zimmerman & Schunk, 2008). Research found that the cognitive strategy used by students in Arabic vocabulary learning remains at a moderate level (Abdul Basit et al., 2017).

Apparently, motivation plays an important role in SRL strategies application (Pintrich, 1999). Gamification is one strategy that enhances motivation in learning (Aleksic-Maslac et al., 2018; Fathoni & Delima, 2017;

Molnar, 2018; Permana & Kusumo, 2018; Rawendy et al., 2017; Yue & Ying, 2017) because of its fun and less pressuring nature. Panadero (2017) noticed that the introduction of computers in SRL research shows promising results not only for measuring but also for scaffolding SRL. This is supported by research conducted by (Chen, 2009; Chen et al., 2018). Several recent studies have examined gamification's role in self-regulated learning. For example, gamified environments were found to significantly enhance both SRL behaviours and learning outcomes in language contexts (Maimaiti & Hew, 2025). However, very few instructional designers emphasise assisting learners in planning, monitoring, and evaluating their learning sessions in an online learning environment using gamification. For example, Chen et al. (2018) suggested further research to compare the effect of their proposed SRL app with and without game elements. This suggests the potential of gamification in SRL. Moreover, there are several research motivating gamifications, but very few for foreign language learning, especially Arabic. Seaborn & Fels (2015) encourage empirical research on the effects of gamification on learning performance or achievement, beyond motivation and engagement. Therefore, this study aimed to develop a Gamification Learning Environment (GLE) to support students' SRL strategies in learning Arabic vocabulary and to examine its effects on students' performance, motivation, and self-regulated learning strategies, as well as the correlations among these variables.

LITERATURE REVIEW

There are different theoretical perspectives on self-regulated learning, including social cognitive, operant phenomenological, volitional, Vygotskian, and cognitive constructive (Ng, 2010). Social cognitive theory is the most extensively used in SRL research among these theories. This study is based on the social cognitive learning perspective by Bandura (1986). Bandura works are widely recognised in the education field as one of the major theories of educational psychology used to date (Zimmerman, 2013). Through his Triadic Reciprocal Model of Causality, self-regulation was introduced. Within this model, human functioning is regulated by interaction of behaviour factors, personal factors, and environmental factors (Bandura, 1986). The term reciprocal refers to mutual action between causal factors, but it is not necessarily simultaneous and self-regulatory system is the core of causal processes (Bandura, 1991). He concluded that behaviour, cognitive and personal factors, and environmental events operate human functioning as interacting determinants of each other (Bandura, 1986). Interaction of these factors can be visualized in the Figure 1 below:

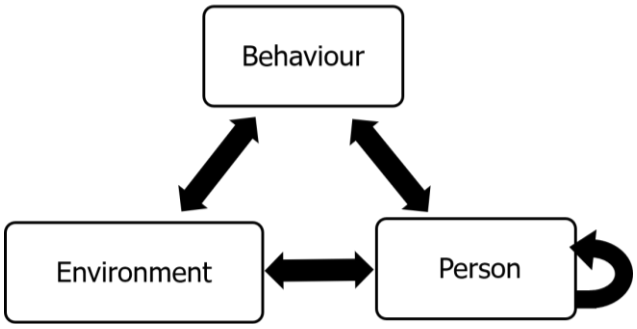


Figure 1 Bandura's Model of Triadic Reciprocality

In this model, reciprocality refers to mutual direction but not necessarily equal. One factor may exert greater influence on another in a given context (Zimmerman, 1989). Personal factors include cognitive and motivation factors such as self-efficacy. Environmental influences may come from teachers or instructional aids. An example of an environmental influence on a person factor is when a teacher praises a student; the student's self-efficacy may increase as a result of the feedback. When students' self-efficacy is high, there are chances of exerting more effort to finish the work, and this is an example of a personal factor influencing behaviour. In the same way, behaviour influences personal factors: greater effort may increase students' self-efficacy. The small loop beside the person factor shows that personal factors can influence one another. Supporting this model, Zimmerman defined SRL as the degree to which students are metacognitively, motivationally, and behaviourally active participants in their own learning processes (Zimmerman, 1989). This theory is the foundation for the gamification learning environment developed in this research.

There are several models of SRL available, such as Zimmerman, Boekaerts, Winne and Hadwin, and Pintrich. Each model gives a different emphasis on the main area of SRL, which is cognitive, motivation and emotion.

Winne and Hadwin's model emphasise metacognition foremost, then motivation, and lastly emotion. Meanwhile, Zimmerman and Pintrich both place importance on motivation, followed by cognition, then emotion. This study chose the Pintrich model because it highlights the motivation area in SRL more explicitly.

Motivation is "the process whereby goal-directed activity is instigated and sustained" (Pintrich & Schunk, 2002, p. 5). Motivation is not a product because it cannot be observed directly, but can be inferred from certain behaviour, therefore it is a process. Motivation involves goals that provide direction and requires activity, whether physical or mental, to attain them. Initiating the first step towards a goal is often difficult, thus motivational processes are important to start and sustain action. In a learning context, although learning could take place without the learner being motivated, motivation plays an important role in learning by leading students to engage in activities that facilitate learning. There are three sources of incentives that influence a person tendency to perform an observationally learned behaviour. First, direct incentives where people more likely to selectively imitate behaviour that give external rewards than unrewarded action or has punishment. Second, vicarious incentives where observed outcomes that are effective for others are favoured over negative outcomes. Lastly, self-produced incentives are those that are self-satisfying and are expressed more than what is disapproved according to the individual's personal standard. These motivational processes are aligned with game structure. Therefore, this study tried to insert gamification into the learning environment, aiming to increase student motivation to apply SRL strategies in learning.

The most popular definition of gamification within a digital context is "the use of game design elements in non-game contexts" as proposed by Deterding, Khaled, Nacke and Dixon in 2011. The concept of gamification is not new in education. Teachers had already implemented game-based activities long before digital video games, such as leaderboards and tokens; however, these were implemented manually, without assistance from technological tools. Today, the term gamification is often used to refer to the gamification of learning in digital contexts. Simões, Redondo, and Vilas (2013) define gamification of education as the use of game elements in a learning environment, usually with the support of ICT. Gamifying learning does not mean changing the learning into a game. There are differences between gamification in education and commercial digital games in terms of its purpose and design. (Brigham, 2015) defined gamification as the addition of game-based elements into a learning approach that acts as a catalyst to increase students' engagement, motivation or learning by solving problems or goals outside the context of a game.

Points, badges, leaderboards, and levels are among the most used gamification elements. This is because these components are easy to apply regardless of the game's genre or type and give an instant effect. Moreover, users with diverse learning styles can benefit from points, badges, and leaderboards, even if their perceptions differ, such as in terms of reward, competition, or challenge. Based on an experiment, points, levels and leaderboards significantly increase the user participation compared to the normal condition, while levels and leaderboards significantly increase user participation compared to the points condition (Mekler et al., 2017). These results showed that the four most effective game elements are points, badges, leaderboards and levels, so these elements are inserted into the developed gamification learning environment.

Research Objectives

Objectives of this study are:

RO 1: To identify the effects of Gamification Learning Environment (GLE) towards students' performance in Arabic vocabulary test, motivation in using self-regulated learning strategies and their SRL strategies.

RO 2: To identify the correlation between students' motivation with self-regulated learning strategies and Arabic vocabulary performance.

The research questions for the first objective (RO 1) are:

RQ1 - Is there significant effect of Gamification Learning Environment towards students' performance in Arabic vocabulary test?

RQ2 - Is there significant effect of Gamification Learning Environment towards students' self-regulated learning strategies use in learning Arabic vocabulary?

RQ3 - Is there significant effect of Gamification Learning Environment towards students' motivation to use self-regulated learning strategies in learning Arabic vocabulary?

The followings are research questions for the second objective (RO 2):

RQ4 - Is there significant correlation between students' motivation and self-regulated learning strategies?

RQ5 - Is there significant correlation between students' motivation and performance in Arabic vocabulary test?

RQ6 - Is there significant correlation between students' self-regulated learning strategies and performance in Arabic vocabulary test?

METHODOLOGY

This study employed a quasi-experimental non-equivalent groups design to examine the effects of a Gamification Learning Environment (GLE) on students' performance, motivation, and self-regulated learning strategies in online Arabic vocabulary learning. A true experimental design with random assignment at the individual level was not feasible due to institutional constraints and the natural classroom setting. Therefore, two intact school groups were used, with one school assigned as the experimental group and the other as the control group.

Although schools were randomly assigned to conditions, individual participants were not randomly allocated, resulting in non-equivalent baseline characteristics between groups. In particular, the control group demonstrated higher pre-test performance levels. Consequently, the findings should be interpreted as the results of associative and comparative analyses. This design is appropriate for authentic educational contexts in which randomisation is impractical, while still allowing a meaningful examination of instructional interventions (Creswell & Creswell, 2017).

Population and Sampling

The population for this study comprises Form 1 (13th-grade) students enrolled in *Kelas Aliran Agama* (KAA) programs at national secondary schools (SMK) in one (1) district in Selangor, Malaysia. These students are part of a specialised stream designed to strengthen Islamic and Arabic language education within the Malaysian national education system; therefore, they represent a relevant demographic for investigating Arabic vocabulary learning and SRL in online and gamified digital environments.

The criteria for selecting the schools are that they must first offer an Arabic language subject for Form 1 students. Second, the syllabus must follow the standard KSSM syllabus and are not other syllabi such as Kerajaan Negeri. Third, the schools are equipped with technology facilities such as the internet and a computer lab. Fourth, the students have experience in learning in an online learning environment. Lastly, to increase the homogeneity of both groups, both schools need to be in the same district or a similar environment so that there are fewer extraneous variables that may influence the students' learning.

In controlling interaction threats, samples for the experimental groups were taken from different schools of the control group. Within the selected schools, intact classes were used, resulting in a non-equivalent groups structure. One school was assigned as the experimental group and the other as the control group. Assignment at the school level was conducted randomly; however, individual students were not randomly assigned to conditions due to administrative and ethical constraints.

Testing threat could occur when samples are taken from different schools; therefore, the researcher followed the same procedure for each school involved. Both groups received an online learning intervention, distinct from their conventional classroom instruction. However, only the experimental group were exposed to gamification while the control group was only provided with an online learning environment without gamification. Schools were randomly assigned to the experimental and control groups.

Samples were drawn from the population using a purposive sampling approach, as participation in the study was voluntary, and students themselves chose to engage with the online learning platform. Invitations to

participate were extended to all Form 1 KAA students in selected schools, and those who consented and accessed the platform formed the final sample. The final sample size was determined based on observed platform engagement and completion rates of the pre- and post-intervention instruments. Initially, 158 students were shortlisted as participants; only 55 were included in the final sample for data analysis.

Instruments

Based on Pintrich's MSLQ (1991), an adapted questionnaire was used to measure students' motivational level and the learning strategies they used to learn Arabic vocabulary. The questionnaire was translated to Bahasa Malaysia to suit the research sample and was reviewed by language, SRL and motivation experts for validations. After correction, it was changed to a 5-point Likert scale containing 83 questions in total, 33 for motivation and 50 for learning strategies. Motivation constructs are intrinsic goal orientation, extrinsic goal orientation, task value, control belief, self-efficacy for learning and performance, and test anxiety. Meanwhile, learning strategies are rehearsal, elaboration, organisation, critical thinking, metacognitive self-regulation, time and study environment, effort regulation, peer learning and help-seeking.

Table 1 Items of the adapted Motivated Self-regulated Learning Questionnaire (MSLQ) instrument used in the study.

Scales	**Dimensions**	**Constructs**	**Item no.**	**Total**
Motivation	Value components	Intrinsic goal orientation	1, 17, 24, 26	4
		Extrinsic goal orientation	7, 11, 12, 14, 32	5
		Task value	4, 10, 18, 25, 28, 29	6
	Expectancy components	Control belief	2, 9, 19, 27	4
		Self-efficacy for learning and performance	5, 6, 13, 16, 21, 22, 23, 31, 33	9
	Affective components	Test anxiety	3, 8, 15, 20, 30	5
Learning strategies	Cognitive & metacognitive strategies	Rehearsal	41, 48, 61, 74	4
		Elaboration	55, 64, 66, 69, 71, 83	6
		Organisation	34, 44, 51, 65	4
		Critical thinking	40, 49, 53, 68, 73	5
		Metacognitive self-regulation	35, 38, 43, 46, 56, 57, 58, 59, 63, 78, 80, 81	12
	Resource management strategies	Time and study environment	37, 45, 54, 67, 72, 75, 79, 82	8
		Effort regulation	39, 50, 62, 76	4
		Peer learning	36, 47, 52	3
		Help-seeking	42, 60, 70, 77	4
Total number of items				83

Table 2 below shows some examples of question:

Table 2 Examples of MSLQ questions

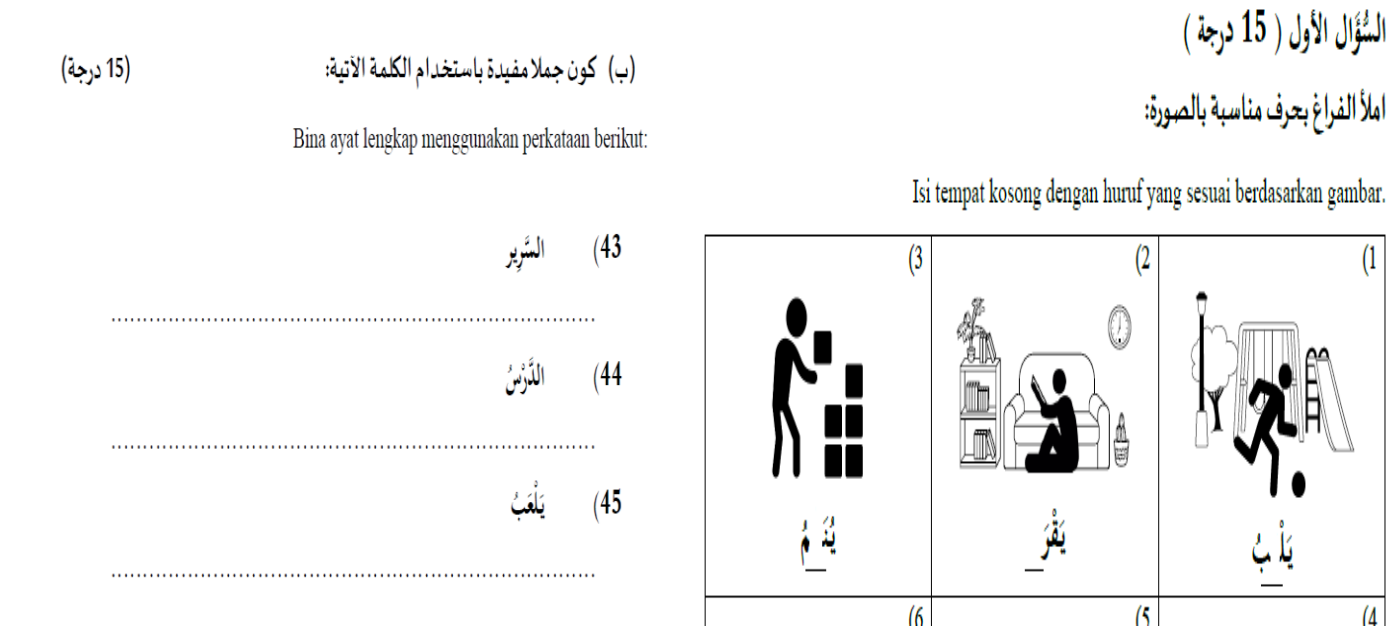
Construct	**Item**	**Samples Questions**
Cognitive Strategies	Rehearsal	48. Sewaktu mengulang kaji mata pelajaran ini, saya membaca nota kelas dan bahan bacaan berulang kali. *When studying for this subject, I read my class notes and the learning material readings over and over again.*
	Organization	51. Saya bina carta ringkas, gambar rajah atau jadual untuk membantu saya menyusun bahan pembelajaran. *I make simple charts, diagrams, or tables to help me organize learning material.*

Resource management strategies	Time and study environment	54. Saya berasa sukar untuk mematuhi jadual belajar. *I find it hard to stick to a study schedule.* **reversed*

An Arabic vocabulary test was also developed to assess students' knowledge of selected target words from Topic 4 of the Form 1 Arabic Language textbook. The test consists of 45 questions divided into 4 sections and 7 sub questions with a total mark of 100. The difficulty levels of questions were based on Bloom's taxonomy.

Table 3 Questions' difficulty level of the Arabic vocabulary test

Section	Question	Marks	Difficulty level	Bloom	Task
1	1 - 15	15	Low	Remember	Fill in correct spelling for items in picture given.
2	16 - 25	20	Low Medium	Remember Understand	Complete word phrase with words given
3	26-30	10	Medium high	Understand Evaluate	Identify words that do not belong to the category
	30-33	12	Medium	Understand Analyze	Find opposite words.
	34-37	8	Low Medium	Remember Analyze	Label word as noun or verb.
4	38-42	20	Medium High	Understand Analyze Evaluate	Rearrange words into sentences
	43-45	15	High	Apply Create	Make sentence using word given.


السُّؤَال الأول (15 درجة)

املأ الفراغ بحرف مناسبة بالصورة:

Isi tempat kosong dengan huruf yang sesuai berdasarkan gambar.

(1 (2 (3

يَا ـْ بُ يَقْ ـْرَ يُنَـ ـْمُ

(4 (5 (6

(ب) كون جملا مفيدة باستخدام الكلمة الآتية: (15 درجة)

Bina ayat lengkap menggunakan perkataan berikut:

(43 السَّرِير .....

(44 الدَّرْسُ .....

(45 يَلْعَبُ .....

Figure 2 Example questions in the Arabic vocabulary test instrument

Gamification Learning Environment (GLE)

Using ADDIE instructional model, two online learning courses was designed and developed for the study using Moodle platform. Vocabulary inserted and tested in this GLE are based on one of the topics included in the Form 1 Arabic Language textbook within the new curriculum standard provided by the Ministry of Education of Malaysia (KSSM). Topic Four was selected and Figure 3 below shows some of the vocabulary included in the topic:

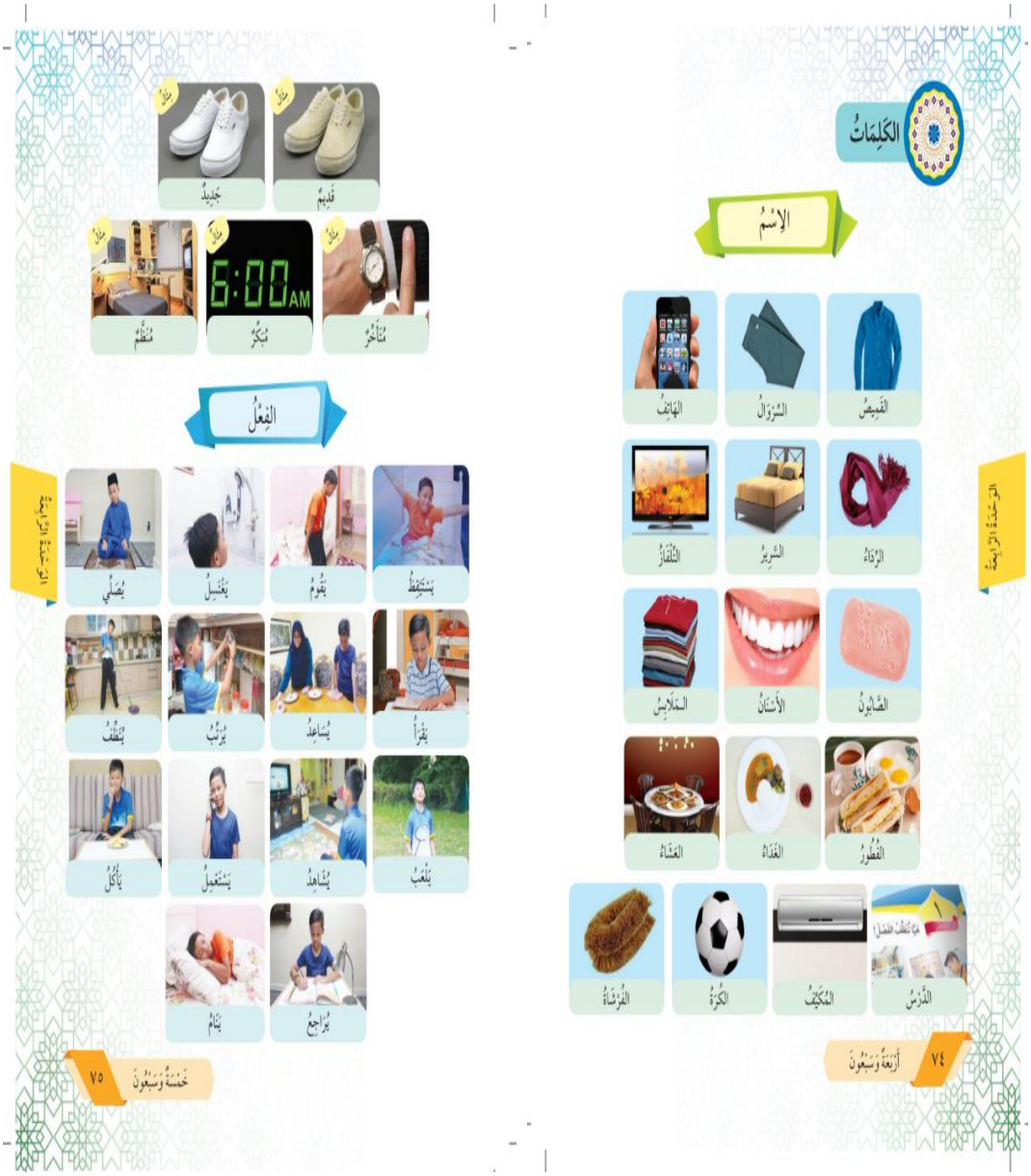


Figure 3 Vocabulary in the Topic 4 of Form 1 Arabic Language textbook

Moodle was selected as the platform to develop and design the GLE because it is a free, open-source, and very customizable platform to fit educational objectives. Although it was introduced in 2002, many educational institutions still use Moodle, indicating its stability and user-friendliness (Bousboula et al., 2025). It also supports both desktop and mobile views. In this study, Moodle is used as a Learning Management System (LMS) while several Learning Content Management systems (LCMS) and plugins are inserted into Moodle, such as Level Up! and Wordwall. Figure 4 below shows the structure of the GLE developed.

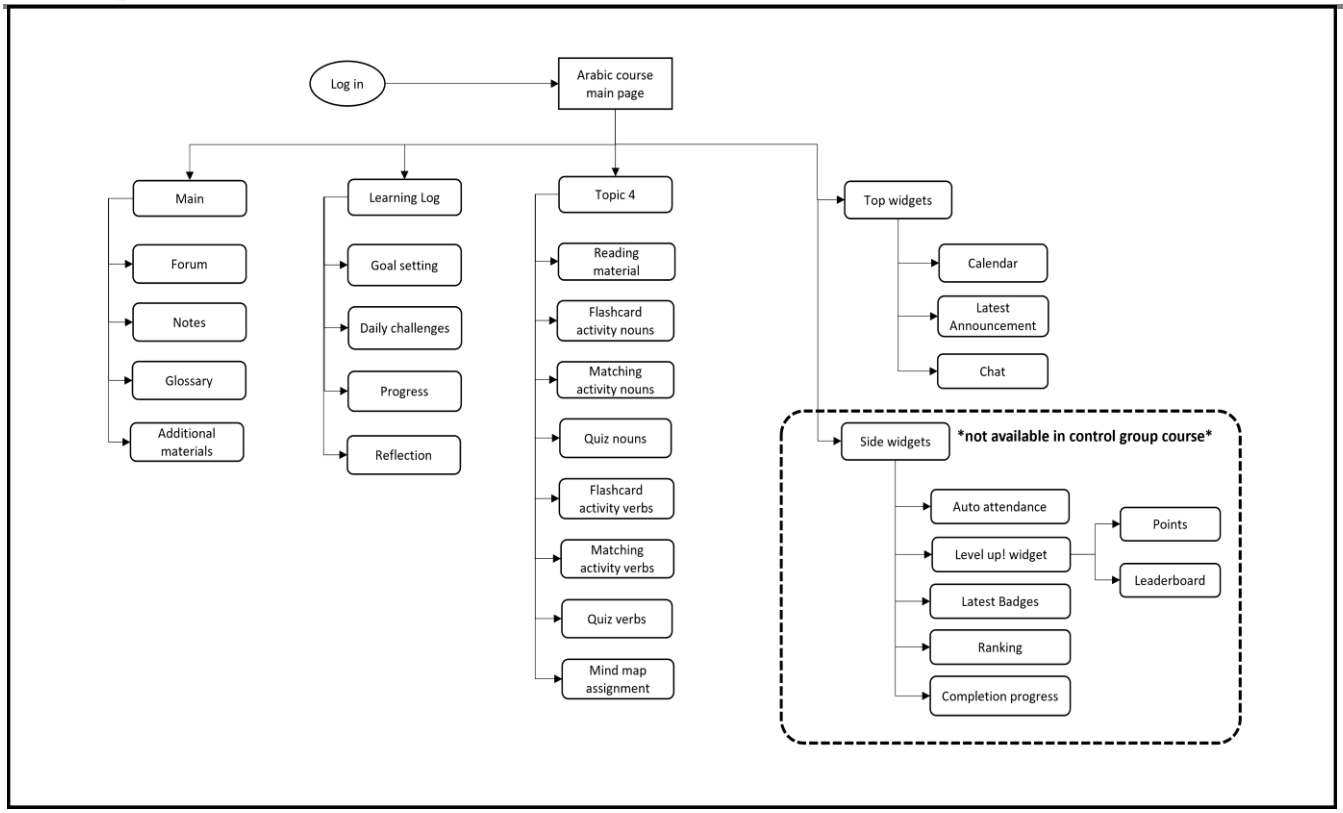


Figure 4 Structure of the developed Gamification Learning Environment (GLE)

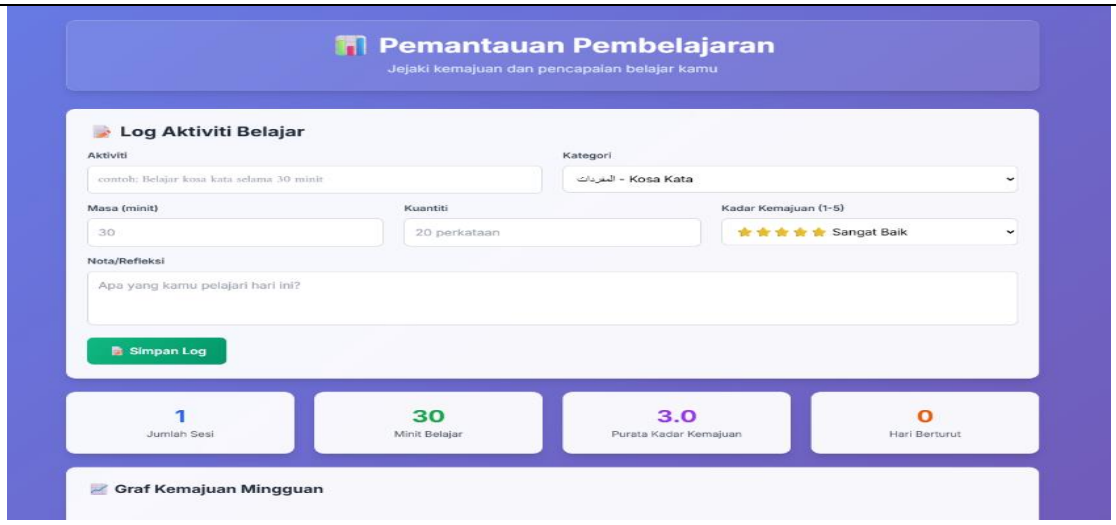
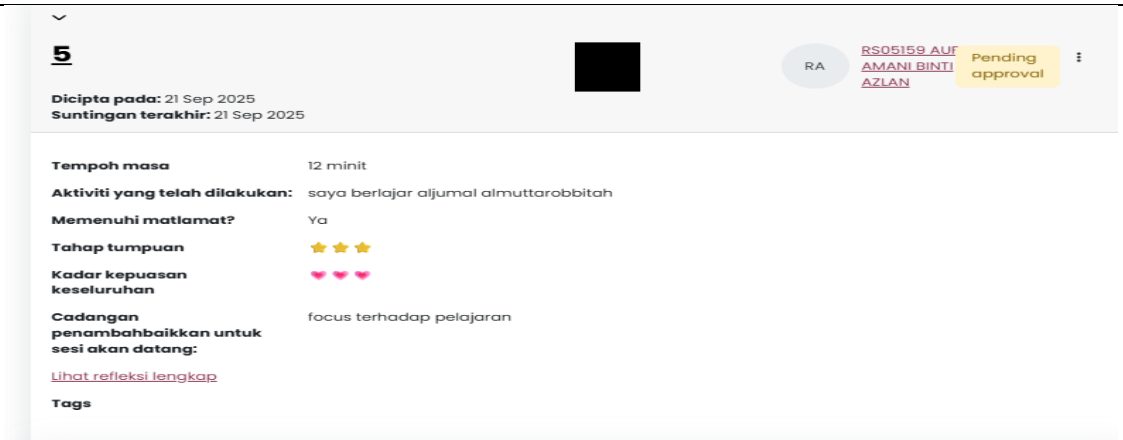
Activities in the learning log, such as Goal setting, Daily challenges, and Progress monitoring, were designed using Canva coding, whereas reflections were designed using Moodle database templates.

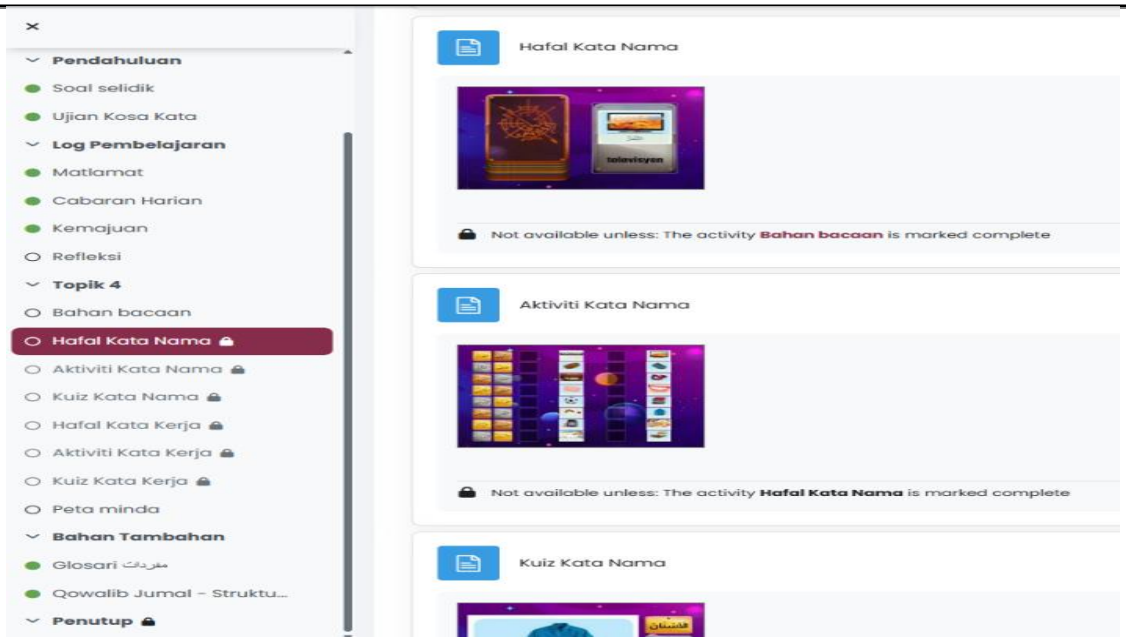
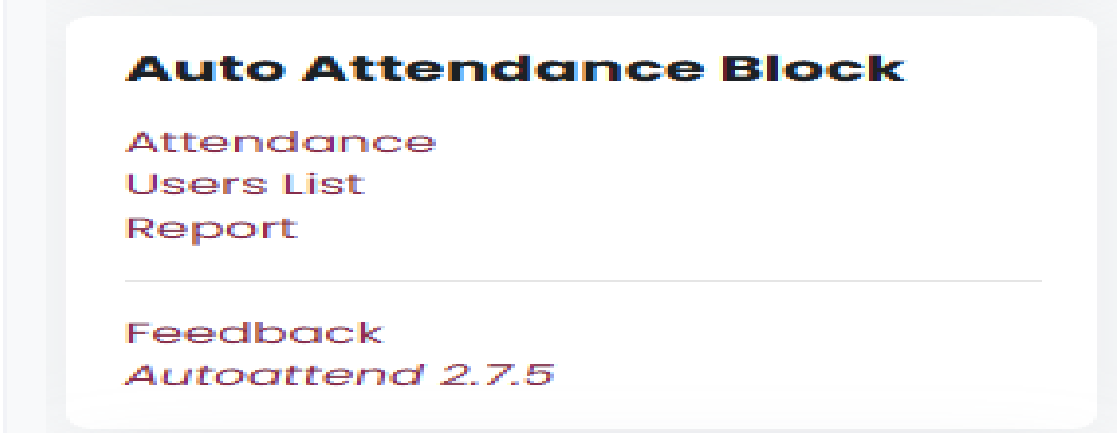
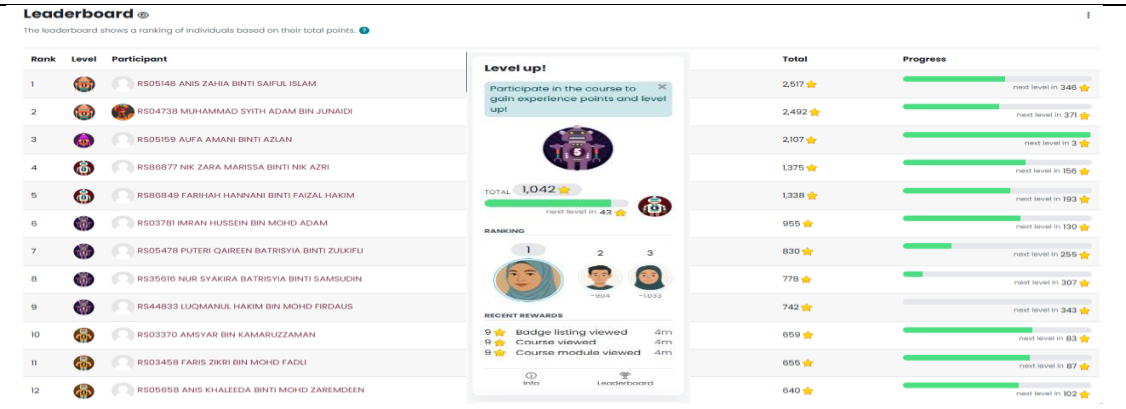
As shown in Figure 4, side widgets are not available in the control-group learning environment and are only included in the experimental-group version of GLE. “Level Up!” is a gamification widget that offers points, levels and leaderboards and was inserted inside the Moodle course. Gamification rules can be set for any events or user actions in the course using this widget. For example, students will be awarded 15 points when they create or update Notes or Reflections.

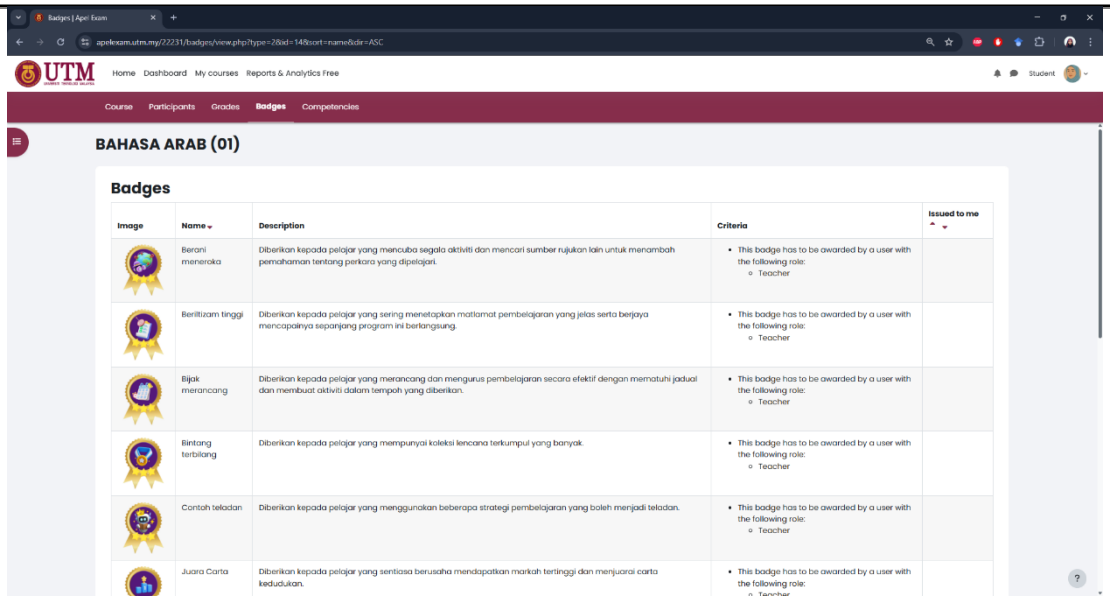
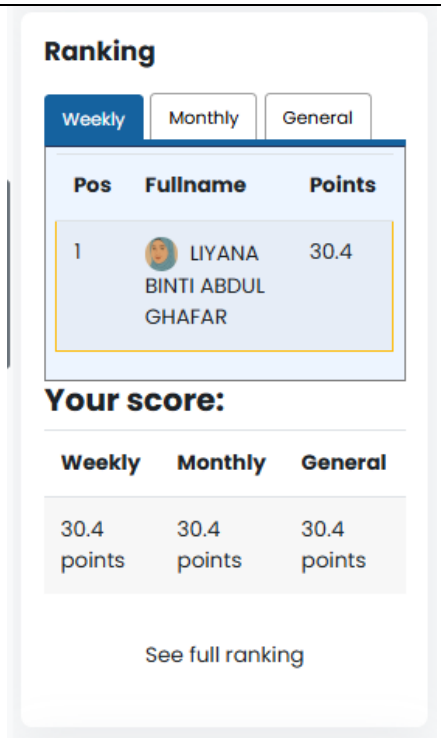
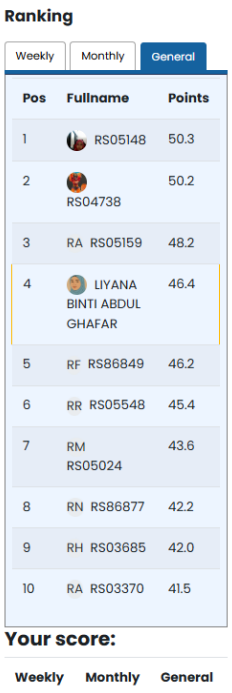
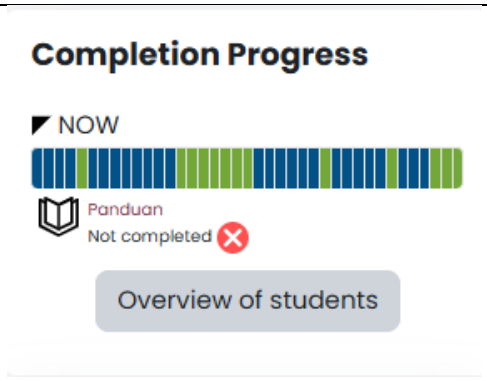
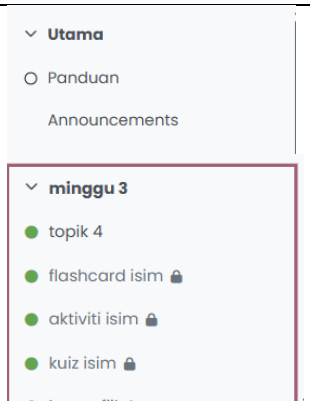
Table 4 below shows the component that was included in the learning environment that was given as intervention to the experimental group:

Table 4 Components of the developed GLE

No.	Components	Screenshot Images
1.	Goal setting	

2.	Daily Challenges	
3.	Monitor progress	
4.	Reflection	

5.	Arabic vocabulary activities for Topik 4	
6.	Auto attendance	
7.	Level up! widget	

8.	Badges	
9.	Ranking	 
10.	Completion Progress / Indicator	 

Components number 1-4 are the learning log features of the learning environment, where, in the experimental course, user actions were counted and awarded using Level up! widget points, level and ranking based on gamification rules set in the settings. In component number 5, the image shows example some of the activities for Topic 4 created using Word wall. For experimental group, activities in number 5 were locked by stages. Numbers 6-10 are features that have gamification elements such as points, leaderboards, and badges.

Excluding the components number 2 (Daily challenges), gamification elements in 5, and components 6-10, the same structure were given to the control group.

Experiment Procedure

Prior to data collection, formal approvals were obtained from the Ministry of Education Malaysia (KPM) and the Selangor State Education Department (JPN). These approvals were essential due to the involvement of school-aged participants. Upon receiving clearance, school principals and teachers were briefed on the research objectives and procedures. Participants were given log in details and instructions to access the Arabic course developed through messaging app group which include parents and students. Two instruments were given to the samples in the pre- and post-test, Motivated Strategies for learning Questionnaire (MSLQ) and Arabic vocabulary test. Students were given time to explore and learn online using the developed learning environment within 3 weeks. Only students who had consented, accessed the online learning platform, and completed the pre and post-test were included in the evaluation phase.

FINDINGS

Normality Analysis

An analysis of the data's distribution conducted using the Kolmogorov-Smirnov and Shapiro-Wilk tests indicate that the overall score distributions are non-normal in both groups. The distribution significantly deviated from normality in both the Control group (n = 18; Shapiro–Wilk p = .003) and the Experiment group (n = 37; p = .016) for pre-test; and for post-test Control group (p = .002) and in the Experiment group (p = .006).

Table 5 Normality test from Arabic vocabulary pre-test and post-test scores

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Pre	Control Group	.205	18	.045	.817	18	.003
	Experiment Group	.122	37	.176	.926	37	.016
Post	Control Group	.244	18	.006	.801	18	.002
	Experiment Group	.117	37	.200*	.911	37	.006
*. This is a lower bound of the true significance.							

The results indicate that the control group has a higher pre-test performance score than the experimental group, which leads to a non-normal distribution of the sample. Since the critical assumption of normality for parametric tests is violated, the Mann-Whitney U test, a robust non-parametric alternative, was selected to compare the distribution of scores between the two independent groups.

RQ 1: Effects of the developed GLE on student performance in Arabic vocabulary test.

The study measured the change in scores from the Arabic pre-test to the Arabic post-test. Through data analysis, it was found that overall, students in the gamified environment did not perform significantly better than students in the control environment. A critical complicating factor is that the Control Group began the study with significantly higher pre-test scores across most sections. This initial advantage makes a direct comparison of improvements difficult. Based on Table 6, there was no statistically significant difference in the overall change score between the Control Group and the Experiment Group, $Z=-1.364$, $p=0.173$, at significance level of $\alpha=0.05$. However, a small effect size was observed ($r = .18$), suggesting a modest practical difference in vocabulary performance between groups.

Table 6 Statistical analysis of scores

	Overall Differences	**Q1 - Q15**	**Q16 - Q25**	**Q26 - Q30**	**Q31 - 33**	**Q34 - Q37**	**Q38 - Q42**	**Q43 - Q45**
Mean Rank Control	32.22	18.89	**36.53**	25.11	**34.11**	**45.86**	13.89	29.92

Group								
Mean Rank Experiment Group	25.95	**32.43**	23.85	29.41	24.54	19.32	**34.86**	27.07
Mann-Whitney U	257.00	169.00	179.50	281.00	205.00	12.00	79.00	298.50
Wilcoxon W	960.00	340.00	882.50	452.00	908.00	715.00	250.00	1001.50
Z	-1.364	-2.989	-2.785	-.959	-2.316	-6.033	-4.576	-.621
Asymp. Sig. (2-tailed)	.173	**.003**	**.005**	.338	**.021**	**<.001**	**<.001**	.535
Control Group = 18. Experimental Group = 37								

Analysis of the sub-categories' score showed a mixed pattern of significant and non-significant differences. The nonparametric analyses show no overall between-group difference in total gains, but baseline-sensitive diagnostics indicate that the GLE particularly benefits students who start at a lower baseline. Mean Rank reflected that the students in experiment group significantly outperformed control group in Q1–Q15 and Q38–42, whereas sections where students in control group started higher at pre-test sometimes favoured the control group (e.g., Q16–25, Q31–33, Q34–37). These findings suggest that the impact of the gamified learning environment was influenced by students' initial performance levels.

Further analysis indicated that students with lower starting scores in the experimental group tended to demonstrate greater improvement. For example, in section Q34–Q37, a strong negative correlation was observed between pre-test scores and improvement (Spearman's $\rho = -.697$, $p < .001$), indicating that lower-performing students benefited more from the intervention. This pattern was weak or absent in the control group. These results suggest that while the gamified environment did not significantly increase overall performance, it supported lower-performing students in catching up in specific vocabulary areas.

RQ 2: Effects of the developed GLE on student motivation to use self-regulated learning strategies in learning Arabic vocabulary

Based on the Mann-Whitney U test results in Table 7, the gamified learning environment did not have a statistically significant effect on the change in student motivation compared to the control group. Table 7 Mann-Whitney test for motivation

Ranks				
	Group	N	Mean Rank	Sum of Ranks
Pre_Motivation	Control Group	18	31.97	575.50
	Experiment Group	34	23.60	802.50
	Total	52		
Post_Motivation	Control Group	18	35.42	637.50
	Experiment Group	37	24.39	902.50
	Total	55		
Diff_Motivation	Control Group	18	28.11	506.00
	Experiment Group	34	25.65	872.00
	Total	52		

Test Statistics[a]			
	Pre_Motivation	Post_Motivation	Diff_Motivation
Mann-Whitney U	207.500	199.500	277.000
Wilcoxon W	802.500	902.500	872.000
Z	-1.895	-2.395	-.558
Asymp. Sig. (2-tailed)	.058	.017	.577
a. Grouping Variable: Group			

Changes in motivation before and after the intervention with Asymp. Sig. (2-tailed) value is .577. Since p-value of .577 is much higher than the standard alpha level of .05, there is no statistically significant difference in the amount of motivation change between the experimental group and the control group. However, a small effect size was observed (r = .08), mean ranks; 28.11 for control compared to 25.65 for experimental is suggesting a modest practical difference in vocabulary performance between groups were not likely due to random chance.

RQ 3: Effects of the developed GLE on students' SRL strategies.

The results for the change in self-regulated learning strategy with Asymp. Sig. (2-tailed) is (p-value) = .628, as shown in Table 8. The p-value is much higher than the standard .05 significance level, there is no statistically significant difference between the experimental and control groups in how much their learning strategies changed. The intervention did not produce a greater improvement in learning strategies compared to the control method. Pre-Overall SRL (p = .462) indicates that at the start of the study, both groups had similar levels of self-learning strategies, suggesting a fair comparison. At the end of the study, there was still no significant difference between the two groups' final scores, as indicated by Post Overall SRL (p = .216).

Table 8 Mann-Whitney Test between Arabic scores and SRL strategies

Ranks				
	Group	N	Mean Rank	Sum of Ranks
Pre Overall SRL	Control Group	18	30.28	545.00
	Experiment Group	37	26.89	995.00
	Total	55		
Post Overall SRL	Control Group	18	31.83	573.00
	Experiment Group	37	26.14	967.00
	Total	55		
Difference Post-Pre SRL	Control Group	18	29.50	531.00
	Experiment Group	37	27.27	1009.00
	Total	55		

Test Statistics[a]			
	Pre Overall SRL	Post Overall SRL	Difference Post-Pre SRL
Mann-Whitney U	292.000	264.000	306.000
Wilcoxon W	995.000	967.000	1009.000
Z	-.735	-1.238	-.484
Asymp. Sig. (2-tailed)	.462	.216	.628
a. Grouping Variable: Group			

Based on the Wilcoxon Signed-Rank Test results, the Gamified Learning Environment (GLE) did not produce a statistically significant change within the experimental group's self-regulated learning strategies. The Mann-Whitney U test also showed that the magnitude of change in strategies did not differ significantly between the two groups. However, a small effect size was observed (r = .07), suggesting a small practical difference in vocabulary performance between groups.

RQ 4: Correlation between motivation and SRL strategies

Table 9 below presents the results of a Spearman correlation analysis for two separate groups: a Control Group (N=18) and an Experimental Group (N=34). The analysis examines the relationships between motivation and learning strategy scores, measured at two time points (pre- and post-intervention) and as a difference score to calculate change.

Table 9 Analysis of the correlation between motivation and SRL strategies.

Correlations (Spearman's rho)

Group			Pre Overall SRL	Post Overall SRL	Difference SRL
Control Group	Pre Overall Motivation	Correlation Coefficient	.451	**.480***	.049
		Sig. (2-tailed)	.060	**.044**	.848
		N	18	**18**	18
	Post Overall Motivation	Correlation Coefficient	**.666****	**.600****	.044
		Sig. (2-tailed)	**.003**	**.009**	.861
		N	**18**	**18**	18
	Difference Motivation	Correlation Coefficient	.129	.125	.090
		Sig. (2-tailed)	.610	.622	.723
		N	18	18	18
Experiment Group	Pre Overall Motivation	Correlation Coefficient	**.629****	**.526****	-.188
		Sig. (2-tailed)	**<.001**	**.001**	.287
		N	**34**	**34**	34
	Post Overall Motivation	Correlation Coefficient	**.506****	**.745****	.209
		Sig. (2-tailed)	**.001**	**<.001**	.214
		N	**37**	**37**	37
	Difference Motivation	Correlation Coefficient	.074	.370*	**.638****
		Sig. (2-tailed)	.676	.031	**<.001**
		N	34	34	**34**

* means the correlation is significant at the p < .05 level.

** means the correlation is highly significant at the p < .01 level.

Among 18 participants in the control group, their motivation scores at both the beginning and end of the study were moderately to strongly correlated with learning strategy scores. For example, Post Overall Motivation was significantly correlated with both Pre Overall SRL (r=.666) and Post Overall SRL (r=.600). This shows that, in general, students with higher motivation also tend to use more learning strategies. It was expected that without an intervention, students' learning strategies would remain highly consistent over time. Critically, there was no significant correlation between changes in motivation and changes in self-regulated learning strategies (r = .090, p = .723). This means that for the control group, any natural fluctuation in motivation was unrelated to any change in their use of learning strategies.

Meanwhile, for the 34 participants who received the gamification intervention, the results show a different and more pronounced pattern: the relationship between motivation and learning strategies after the intervention is very strong. The correlation between Post Overall Motivation and Post Overall SRL is r=.745 (p<.001), which is considerably stronger than the same relationship in the control group (r=.600). The most important result is the strong, positive, and highly significant correlation between the change in motivation and the change in self-regulated learning strategies (r=.638, p= <001). The data support the conclusion that the intervention successfully demonstrated a significant relationship between growth in student motivation and increased use of learning strategies.

RQ 5 & 6: Correlations between motivation and SRL strategy with performance.

An analysis of the correlation between students' motivation and SRL strategies towards their performance in learning Arabic vocabulary showed no statistically significant correlation in either the control or the experimental group.

Table 7 Correlation of motivation with performance

Group			Pre_Motivation	Post_Motivation
Control Group	Markah_PRE	Correlation Coefficient	-.199	-.118
		Sig. (2-tailed)	.428	.642
		N	18	18
	Markah_POS	Correlation Coefficient	-.184	.182
		Sig. (2-tailed)	.464	.470
		N	18	18
Experiment Group	Markah_PRE	Correlation Coefficient	.062	-.117
		Sig. (2-tailed)	.727	.490
		N	34	37
	Markah_POS	Correlation Coefficient	-.126	-.232
		Sig. (2-tailed)	.476	.167
		N	34	37

Table 8 Correlation SRL strategies with performance

	Group			Pre_LearningStgy	Post_LearningStgy	Diff_LearningStgy
	Control Group	Markah_PRE	Correlation Coefficient	-.167	-.026	.165
			Sig. (2-tailed)	.507	.919	.512
			N	18	18	18
		Markah_POS	Correlation Coefficient	-.198	-.085	.088
			Sig. (2-tailed)	.432	.738	.729
			N	18	18	18
		Markah_Diff	Correlation Coefficient	.084	.011	-.037
			Sig. (2-tailed)	.741	.964	.883
			N	18	18	18
	Experiment Group	Markah_PRE	Correlation Coefficient	-.183	-.094	-.088
			Sig. (2-tailed)	.299	.578	.621
			N	34	37	34
		Markah_POS	Correlation Coefficient	-.301	-.146	.207

			Sig. (2-tailed)	.084	.390	.241
			N	34	37	34
		Markah_Diff	Correlation Coefficient	-.213	-.167	.270
			Sig. (2-tailed)	.226	.322	.123
			N	34	37	34

While the GLE successfully linked motivation to strategy (RQ4), this positive effect did not carry over to the final goal: better performance on the vocabulary tests. For students in the gamified environment, increases in motivation or use of learning strategies did not lead to higher scores. This outcome stands in contrast to studies that demonstrate a significant positive impact of gamification on academic performance, often mediated by enhanced motivation (García-López et al., 2023; Shen et al., 2024). This discrepancy suggests that while gamification can enhance engagement and foster strategic approaches to learning, its direct translation to improved academic performance is not always guaranteed and may depend on specific implementation characteristics (Jaramillo-Mediavilla et al., 2024; Shen et al., 2024).

CONCLUSION

The present study examined the effects of a Gamification Learning Environment (GLE) on students' Arabic vocabulary performance, motivation, and self-regulated learning (SRL) strategies within an authentic online learning context. The findings indicate that the developed GLE did not produce a statistically significant overall difference in performance between the experimental and control groups. However, the results revealed a meaningful pattern in which students with lower initial vocabulary performance demonstrated greater improvement within the gamified environment. This suggests that the GLE may function more effectively as a targeted instructional support rather than as a universal performance enhancer.

This finding is consistent with previous studies showing that gamified or game-based learning environments may not always produce significantly higher overall test scores compared to traditional instruction but can improve learning outcomes for specific groups or content areas (Cabrera-Solano, 2022; Hernández-Fernández et al., 2020). The results therefore indicate that the effectiveness of gamification may be context-dependent and particularly beneficial for students with lower initial achievement levels.

Although some recent studies have reported strong positive effects of gamification on both self-regulated learning and academic performance (Maimaiti & Hew, 2025), the current findings suggest that such effects may be highly context-dependent, as they are supported by continuous behavioural analytics and adaptive feedback. The findings further suggest that gamification may function more effectively as a targeted instructional support rather than a universal performance-enhancing strategy. The observed improvement among lower-performing students aligns with research indicating that gamified environments can enhance engagement and motivation among learners who initially struggle, thereby supporting gradual improvement in foundational knowledge (Kiss et al., 2024; Lee, 2023; Puig et al., 2022). Consequently, gamification may be most effective when implemented strategically to support learners with specific learning needs rather than as a blanket instructional approach across all learners.

The correlation analysis further demonstrated that, within the experimental group, increases in motivation were strongly associated with increased use of SRL strategies. This relationship was considerably stronger than that observed in the control group, indicating that the gamified environment successfully strengthened the link between students' motivational processes and their learning strategies. Nevertheless, these motivational and strategic improvements did not directly translate into significantly higher vocabulary performance within the duration of the intervention. This finding suggests that changes in motivation and self-regulatory awareness may precede measurable achievement gains, particularly in short-term interventions.

Although statistical significance was not achieved, the observed small effect size for vocabulary performance indicates that the gamified learning environment may have produced modest educational benefits. This pattern suggests that motivational and self-regulatory changes may precede measurable performance gains, particularly within short intervention periods. The findings therefore highlight the importance of interpreting

instructional interventions not only through statistical significance but also through the magnitude and direction of observed effects within real educational settings.

The non-equivalent baseline performance between groups should also be considered when interpreting the findings. The control group demonstrated higher pre-test scores, which may have influenced the magnitude of observable improvement and limited direct comparison of gains between groups. Consequently, the results should be interpreted as indicative of comparative patterns rather than definitive causal effects. The improvement observed among lower-performing students in the experimental group may therefore reflect an interaction between initial performance level and the gamified learning environment rather than a uniform treatment effect across all learners.

One potential reason for this result is that the Control Group may have already been slightly more motivated and strategic at the start of the study. This would make it difficult for the GLE to achieve a greater increase in learning strategies than the traditional group. Consequently, the gamified environment did not demonstrate a significantly greater effect on students' self-regulated learning strategies compared to the conventional online learning approach. This finding suggests that while gamification can foster engagement, it may not inherently cultivate more sophisticated self-regulation techniques without explicit instructional design focusing on strategy development (Li et al., 2022). The present study therefore evaluates the gamified learning environment as a holistic instructional design rather than isolating individual gamification components. This aligns with research indicating that while gamification can boost motivation and engagement, its impact on cognitive dimensions and self-regulation necessitates a targeted instructional approach (Li et al., 2022).

This interpretation is consistent with previous research indicating that self-reported measures of self-regulated learning often exhibit limited predictive power, reflecting a potential discrepancy between learners perceived regulatory abilities and their actual strategic behaviours (Panadero, 2017). In addition, self-regulation does not necessarily translate into improved use of learning tools or learning outcomes in all contexts, particularly when learners are not explicitly guided in how to apply these strategies effectively (Boudouaia et al., 2024). This highlights the complexity of measuring and influencing self-regulated learning, as students' self-awareness of their strategies may not always align with their observable behaviours or learning outcomes (Kleinman et al., 2021). Therefore, further research may include multimodal methods, such as trace data or behavioural measures, using data tracking or logs rather than self-reports alone.

Limitation And Future Research

The relatively small final sample size limits the generalizability of the findings beyond the participating schools. As participation was voluntary and intact school groups from different schools were used, the findings should be interpreted as comparative rather than strictly causal. Effect size analysis was therefore included to provide an indication of the magnitude of observed differences alongside statistical significance.

Non-equivalent baseline performance between the control and experimental groups may also have influenced the magnitude of observable improvement, as the control group demonstrated higher pre-test scores. Accordingly, the findings should be interpreted as reflecting comparative patterns and possible interactions between initial performance levels and the gamified learning environment rather than a uniform treatment effect.

In addition, self-regulated learning (SRL) was measured using self-reported instruments, which primarily capture perceived rather than directly observed learning behaviours. This may explain why strengthened motivation–SRL relationships were not accompanied by significant performance gains within the intervention period.

The gamification elements were implemented as an integrated learning environment rather than as isolated components, reflecting authentic instructional practice but limiting identification of the contribution of individual gamification features. Furthermore, the absence of qualitative or behavioural engagement data constrains deeper interpretation of learner experiences. Future research is therefore encouraged to incorporate multimodal data sources, such as learning analytics, engagement logs, or qualitative feedback, to better understand how gamified learning environments influence motivation, self-regulated learning, and learning outcomes over time.

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