

Game-based learning and student motivation in digital classrooms

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ABSTRACT

The development of digital learning requires teachers to implement a learning model that not only delivers material but can also maintain students' attention and motivation to learn. *Game-Based Learning* (GBL) is a relevant approach because it integrates challenges, scores, live feedback, and interactive learning experiences. This study aims to analyse differences in student learning motivation before and after the implementation of GBL in digital classrooms at MTsN 1 Kendari. The research employed a quantitative approach with a quasi-experimental one-group pretest-posttest design. The research sample consisted of 102 students of digital classes who were selected using saturated sampling. The research instrument was in the form of a learning motivation questionnaire consisting of 19 statements and had a reliability of Cronbach's alpha of 0.871. Data were analysed using descriptive statistics, the Kolmogorov-Smirnov normality test, and a paired sample t-test. The results showed that the average learning motivation score increased from 24.4118 in the pretest to 25.9412 in the posttest. The t-test results showed a significant difference between the pretest and posttest scores, $t(101) = -2,990$; $p = 0.004$. The size of Cohen's d_z effect of 0.296 suggests that the increase belonged the small category. These findings suggest that GBL has the potential to increase students' motivation to learn in the context of digital classrooms, although its practical impact still needs to be strengthened through a longer implementation and experimental design with control groups.

INTRODUCTION

Digital transformation encourages schools to develop learning that is more flexible, interactive, and relevant to the characteristics of today's students. Web-based learning media, digital quiz platforms, digital modules, and technology-assisted learning environments have been widely used to enrich students' learning experiences (Ahyani et al., 2022; Iswanto et al., 2024; Misu et al., 2023; Nanggara & Laksono, 2023; Pratiwi et al., 2024). In this context, teachers are not enough to move material into a digital space; they need to design activities that keep students active, focused, and have the drive to complete a learning task.

Learning motivation is a vital aspect of digital learning because it determines the extent to which students pay attention, persevere in learning activities, and strive to achieve good results. Recent research unveils that learning motivation is associated with student engagement, learning interests, confidence, and meaningful learning experiences (Debi & Widiyasari, 2025; Islam et al., 2024; Li et al., 2024; Ulpa & Jamal, 2024). Students possessing high motivation tend to be more active in following instructions, dare to try, and are better prepared for learning challenges. Meanwhile, those with low motivation are more likely to be passive and lose focus.

One approach to increasing learning motivation is *Game-Based Learning* (GBL). GBL integrates elements of play into the learning process, such as challenges, scores, time limits, rankings, live feedback, and digital rewards. Various systematic reviews show that the use of game elements can increase student engagement and motivation when designed according to learning objectives (Arufe-Giráldez et al., 2022; Camacho-Sánchez et al., 2023; Dahalan et al., 2023; Lampropoulos et al., 2022; Ratinho & Martins, 2023; Videnovik et al., 2023; Zhang & Yu, 2022). Thus, games in learning are not positioned as mere entertainment, but as pedagogical strategies to manage students' attention, participation, and learning experiences.

The theoretical framework of this study positions GBL as a pedagogical stimulus that operates through three main mechanisms: structured challenges, immediate feedback, and the visualisation of learning outcomes. Challenges provide students with clear short-term goals, feedback enables them to promptly understand the quality of their responses, while the visualisation of learning outcomes provides information about learning progress. These mechanisms are expected to strengthen students' learning engagement, self-confidence, and perceptions of success. This model is consistent with the findings of Chen and Liang (2022), who showed that gamification can influence learning engagement through enjoyment and self-efficacy, as well as the findings of Li, Chen, and Deng (2024), who emphasised that digital educational games affect motivation through learning engagement and support from the digital environment. Within this framework, learning motivation is understood as the result of the interaction among activity design, student experience, and the readiness of the digital environment.

In digital learning practices, apps like Quizizz and Kahoot are often used because they provide a fast, competitive, and responsive learning experience. Recent research proves that digital quizzes and gamification can increase student participation, self-efficacy, interest in learning, and engagement in online and face-to-face learning (Alsswey & Malak, 2024; Hernanz et al., 2024; Mesterjon et al., 2024; Nadeem et al., 2023; Özdemir, 2025; Tandiono, 2024; Temel & Cesur, 2024). Several other studies have also revealed that GBL can support language learning, computers, and basic education because it presents clear challenges as well as immediate feedback (Kaldarova et al., 2023; Latifah & Sari, 2025; Shen et al., 2024).

However, the effectiveness of GBL varies in every context. Recent studies confirm that the impact of gamification and GBL is influenced by activity design, feedback quality, technological readiness, digital environment, and learner characteristics (Balalle, 2024; Jääskä et al., 2022; Jaramillo-Mediavilla et al., 2024; Li et al., 2024; Li et al., 2024; Ruiz et al., 2024; Zheng et al., 2023). This means that the success of GBL depends not only on the use of the game application, but also on how the teacher connects the game elements to the learning objectives and the students' needs.

The context of digital classroom-based madrasahs is an influential space to be studied. Several studies in Indonesia validate that GBL and digital media can enhance the quality of students' learning, interests, and learning outcomes at various levels of education (Figriah et al., 2025; Indriani & Puspitasari, 2024; Indriyani & Tofaynudin, 2025; Kuswoyo, 2025; Raharjo et al., 2024; Rahayu et al., 2024). In addition, research related to digital media by Saputra and colleagues shows that the development of web-based media and e-learning is relevant to support technology-based learning in schools (Ahyani et al., 2022; Landebila et al., 2024; Misu et al., 2023).

Based on the initial observations at MTsN 1 Kendari, the school has implemented digital classes assisted by tablet devices and internet access. The teachers have also employed digital game media such as Quizizz and Kahoot. However, some students showed passive behaviour, were slow to respond to digital evaluation activities, and lacked enthusiasm for learning. This condition indicates that technology does not automatically boost students' learning motivation without the proper learning strategy.

Based on these gaps, this study aims to analyse the differences in students' learning motivation before and after the implementation of GBL in digital classrooms at MTsN 1 Kendari. This study hypothesises that there is a significant difference between students' learning motivation before and after the implementation of GBL. This research is expected to make an empirical contribution to the study of digital learning in madrasas, especially regarding the use of GBL to increase student learning motivation.

METHODS

This study uses a quantitative approach with a *quasi-experimental method*. The research employed a one-group pretest-posttest design. This design was used to analyse differences in students' learning motivation before and after the implementation of *Games-Based Learning* (GBL) in digital classrooms. Students first filled out a learning motivation questionnaire as the pretest, then took part in learning using GBL, and then filled out the same questionnaire as the posttest (see [Table 1](#)).

The research took place at MTsN 1 Kendari in the digital classroom during the 2025/2026 academic year. The research population consisted of all students of the digital class, totalling 102 students. The sampling technique was saturated sampling because all population members were also the research sample. This technique was selected to ensure that the data obtained accurately reflected the conditions of all students in the digital classroom, where the research was located. Accordingly, the findings of this study represent changes in learning motivation within the digital class group, although generalisation to other contexts should still be made with caution.

Table 1. One-group pretest-posttest research design

Groups	Pretest	Treatment	Posttest
Digital classroom	O ₁	X	O ₂

Remarks: O₁ = measurement of learning motivation before treatment; X = learning using GBL; O₂ = measurement of learning motivation after treatment

The research treatment consisted of implementing game-based learning (GBL) through the Quizizz and Kahoot applications. The teacher presented interactive questions related to the learning materials, set time limits for task completion, displayed scores, and provided immediate feedback after students submitted their answers. The game elements employed included challenges, scores, rankings, time limits, opportunities for repeated attempts, and immediate responses to students' answers. These elements were selected because they were aligned with the theoretical framework of the study, namely facilitating students' attention, engagement, self-confidence, and learning satisfaction. The implementation of GBL was not positioned merely as an entertainment activity, but was integrated with learning objectives and formative assessment.

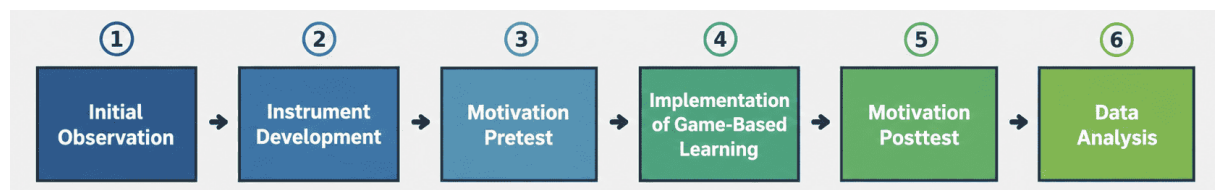
The research instrument was a student learning motivation questionnaire consisting of 19 statements. The instrument was developed through four stages: determining the construct of learning motivation, formulating indicators, writing the statement items, and reviewing the appropriateness of the content and language before its use. The indicators employed included interest in learning, attention to the learning materials, enthusiasm, active participation during the learning process, persistence in completing tasks, and the desire to achieve good learning outcomes. The blueprint of the instrument used in this study is presented in [Table 2](#).

Data were collected using Google Forms to align with the digital classroom context and to facilitate the recapitulation of students' responses. Each statement employed a five-point Likert scale, consisting of strongly agree, agree, undecided, disagree, and strongly disagree. The collected data were checked for completeness before the analysis. Data analysis was conducted using IBM SPSS Statistics through several stages. First, descriptive statistics were used to obtain the minimum, maximum, mean, standard deviation, and standard error values. Second, the Kolmogorov-Smirnov normality test was employed to ensure that the data distribution met the assumptions for parametric analysis. Third, a paired-samples t-test was used to examine differences between pretest and posttest scores at a significance level of 0.05.

Table 2. Grid of learning motivation instruments

Indicator	Measurement focus	Number of grains
Interest in learning	Student interest in digital learning activities and game-based quizzes.	4
Attention	Student concentration when following instructions, materials, and quiz questions.	4
Enthusiasm	Students' enthusiasm for participating in challenges, scores, and learning activities.	4
Activity	Student involvement in answering questions and participating in the learning process.	4
Results orientation	Students' desire to achieve good learning outcomes and improve their achievements.	3

Fourth, the pretest–posttest correlation and Cohen's d_z were calculated to examine the relationship between measurements and the practical magnitude of score changes (see Figure 1).

**Figure 1. Research procedure flow**

RESULTS

This study involved 102 students of the MTsN 1 Kendari digital class. The data were obtained from learning motivation questionnaires given before and after the implementation of GBL. The results of the study were presented through instrument reliability analysis, descriptive statistics, normality test, hypothesis test, pretest-posttest correlation, and effect size.

Table 3. Instrument reliability test results

Variable	Cronbach's alpha	Number of items	Remarks
Learning motivation	0,871	19	Reliable

Table 3 shows that the instrument has good reliability. Cronbach's alpha value of 0.871 indicates that the 19 statements in the questionnaire have sufficient internal consistency to measure student learning motivation. The instrument compared the conditions of learning motivation before and after the implementation of GBL.

Table 4. Descriptive statistics of student learning motivation

Measurement	N	Minimum	Maximum	Red	Standard deviation	SE Red
Pretest	102	12,00	41,00	24,4118	6,45679	0,63922
Posttest	102	12,00	36,00	25,9412	5,32661	0,52741

Based on Table 4, the average learning motivation increased from 24.4118 in the pretest to 25.9412 in the posttest. The average difference of 1.5294 points showed an increase in learning motivation scores after the implementation of GBL (see Figure 2). The smaller standard deviation of the posttest compared to the pretest also indicates that students' learning motivation scores became slightly more homogeneous after the treatment.

The normality test's significance value of 0.189 is higher than 0.05. Since the data conforms to the normality assumption, it can be analysed using a paired sample t-test (Table 6). The results of the paired sample t-test showed a significance value of 0.004, smaller than 0.05. Thus, there is a significant difference between students' learning motivation before and after the implementation of GBL.

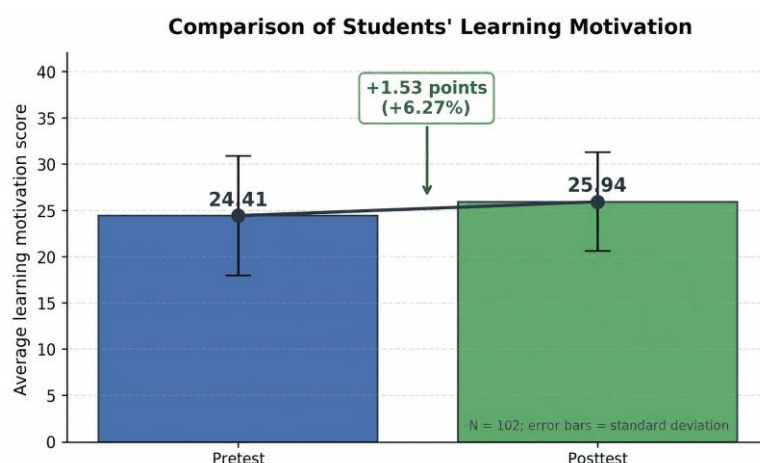


Figure 2. Comparison of average student learning motivation scores

Table 5. Kolmogorov-Smirnov normality test results

Components	Value
N	102
Test statistic	0,074
Asymp. Sig. (2-tailed)	0,189
Remarks	Normal distribution

Table 6. Paired sample t-test results

Data Pairs	Mean Difference	SD Difference	OR	95% CI Lower	95% CI Upper	t	df	Sig.
Pretst-Posttest	-1,52941	5,16597	0,51151	-2,54410	-0,51472	-2,990	101	0,004

The mean difference value is negative because the calculation is done by subtracting the posttest score from the pretest score, thus indicating that the posttest score is higher than the pretest.

Table 7. Pretest and posttest correlation results

Data Pairs	N	Correlation	Sig.
Pretest and posttest	102	0,631	<0.001

Table 7 shows the correlation value of 0.631 indicates a fairly strong positive relationship between pretest and posttest scores. This means that students with higher initial motivation tend to remain with higher motivation scores after treatment. In other words, the implementation of GBL increased the average learning motivation, but the relative position of students with high and low initial motivation remained relatively consistent.

Table 8. Measure the effect of change in learning motivation

Components	Value
Difference between posttest and pretest average	1,52941
Standard deviation of score difference	5,16597
Cohen's dz	0,296
Interpretation	Small

Table 8 depicts Cohen's dz value of 0.296 indicates that the increase in learning motivation belongs to the small category. Thus, the implementation of GBL provides a statistically significant improvement, but the practical impact remains limited. This finding is influential because it clarifies that GBL has the potential to increase learning motivation, but its practical effectiveness still needs to be strengthened through more intensive and sustainable activity design.

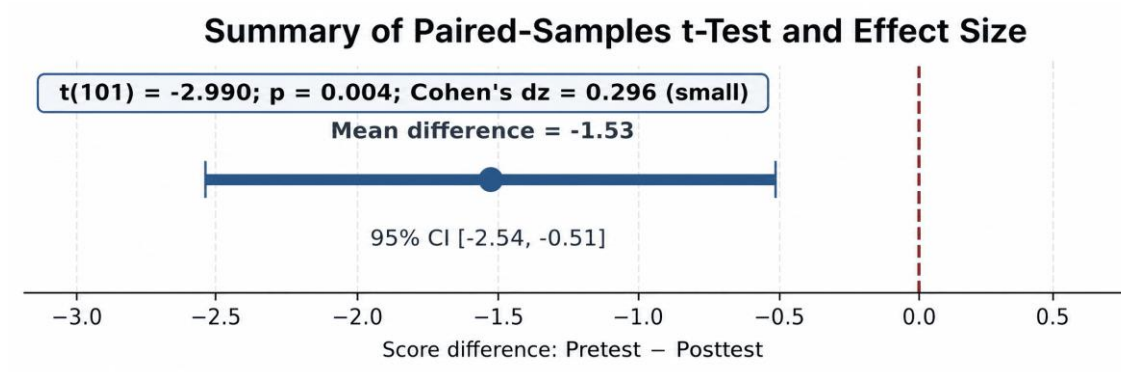


Figure 3. Summary of paired sample t-test and effect size

DISCUSSION

The results of the study indicate that the application of *Games-Based Learning* (GBL) is associated with increasing students' learning motivation in the digital classroom at MTsN 1 Kendari. The average learning motivation score increased from 24.4118 to 25.9412, and the results of the paired sample t-test showed a significant difference, $t(101) = -2.990$; $p = 0.004$. These findings support various cutting-edge studies that demonstrate that game-based learning and gamification in enhancing students' motivation, engagement, and learning experience (Jaramillo-Mediavilla et al., 2024; Li et al., 2024; Ratinho & Martins, 2023; Zhang & Yu, 2022).

This increase in motivation can be explained through the attributes of GBL, which allow a more engaged learning experience than conventional learning. The elements of scores, challenges, time limits, and ratings encourage students to respond immediately to questions, try again when they make mistakes, and focus on the learning process to the end. This mechanism supports the findings of Li et al. (2024) that digital educational play can influence motivation through learning engagement and digital environment support. The findings of Zheng et al. (2023) also verify that digital game-based learning influences student motivation and engagement when designed in a directed manner.

The Quizizz and Kahoot applications used in this study have influential characteristics for building learning motivation, namely, quick feedback and learning outcomes visualisation. Immediate feedback helps students comprehend the results of their answers immediately, while scores and rankings allow them to witness their progress during the activity. These results support the study by Hernanz et al. (2024), which show that Quizizz can enhance self-efficacy, intrinsic motivation, satisfaction, and performance. These findings are also consistent with the research by Alsswey and Malak (2024), Tandiono (2024), and Özdemir (2025) regarding Kahoot's contribution in strengthening engagement and learning outcomes.

In the context of digital classrooms, GBL works not only through the element of competition, but also through the creation of a lighter and more fun learning atmosphere. Students have the opportunity to answer questions in a game format, see system responses, and compare achievements directly. This condition can reduce boredom and encourage students to be more courageous in participating in learning activities. Research by Nadeem et al. (2023), Temel and Cesur (2024), Shen et al. (2024), Latifah and Sari (2025), and Mesterjon et al. (2024) demonstrates that game-based learning and digital quizzes can enhance student interest, motivation, and engagement in a technology-based learning environments.

However, the effect size in this study was in the small category, namely Cohen's $dz = 0.296$. This means that although the increase in learning motivation is statistically significant, its impact is practically not large. These findings need to be read carefully because learning motivation is an affective construct that is influenced by multiple factors, including learning habits, student readiness, quality of teacher interaction, classroom conditions, and students' experience with

technology. [Li et al. \(2024\)](#) assert that gamification can increase intrinsic motivation, autonomy, and connectedness, but its impact on competence is not always strong. [Ratinho and Martins \(2023\)](#) also remind us that the motivational effect of gamification can decrease if activities only rely on novelty or external rewards.

The small effect size can also be attributed to the design of the GBL application, which is limited to pre- and post-treatment measurements without a control group. The design of a one-group pretest-posttest can indeed indicate a change in scores, but it cannot completely rule out the possibility of outside influences. Therefore, the results of this study are more accurately interpreted as an increase in learning motivation after the GBL implementation, not as an absolute causal claim. This view supports [Balalle \(2024\)](#), [Ruiz et al. \(2024\)](#), and [Jääskä et al. \(2022\)](#), who emphasise the significance of design, context, and implementation strategies in assessing the effectiveness of game-based learning.

The findings of this study are also relevant to the results of research in Indonesia. [Debi and Widiyasari \(2025\)](#), [Islam et al. \(2024\)](#), [Ulpa and Jamal \(2024\)](#), [Fiqriah et al. \(2025\)](#), [Indriani and Puspitasari \(2024\)](#), [Indriyani and Tofaynudin \(2025\)](#), [Kuswoyo \(2025\)](#), [Raharjo et al. \(2024\)](#), and [Rahayu et al. \(2024\)](#) unveiled that GBL, educational games, and digital learning media can encourage student interest, motivation, and involvement. The similarity of these findings suggests that GBL has strong potential in various learning contexts, including madrasas. However, these local references are more appropriately positioned as contextual evidence, whereas the strengthening of the theoretical foundation should continue to rely on reputable and up-to-date international literature.

Research on the development of digital media has also shown that technological readiness is an important factor in the success of game-based learning. [Ahyani et al. \(2022\)](#) show that web-based learning media can be used as a learning supplement that supports student learning activities. [Landeabila et al. \(2024\)](#) developed Moodle e-learning with the concept of gamification and demonstrated the feasibility of media for learning. Both articles are relevant to this research because they both place digital technology as a means to strengthen the learning experience, not just a tool for delivering material. In addition, research by [Misu et al. \(2023\)](#), [Iswanto et al. \(2024\)](#), [Nanggara and Laksono \(2023\)](#), [Panggabean et al. \(2022\)](#), and [Pratiwi et al. \(2024\)](#) show that technology-based learning media needs to be developed according to student needs, school readiness, and learning goals. The support of digital facilities at MTsN 1 Kendari is an important factor that allows GBL to be implemented more effectively. Without devices, internet networks, and teacher readiness, game elements such as digital quizzes, instant feedback, and leaderboards cannot run optimally.

Theoretically, the results of this study reinforce the view that learning motivation can grow when students gain attention, clear challenges, confidence, and satisfaction in learning. GBL elements support these aspects through challenging, interactive, and hands-on feedback. However, the success of GBL remains dependent on pedagogical design. Game activities need to be associated with learning objectives, not just used as a variety of entertainment. This is in line with the systematic studies of [Dahalan et al. \(2023\)](#), [Camacho-Sánchez et al. \(2023\)](#), [Lampropoulos et al. \(2022\)](#), [Kaldarova et al. \(2023\)](#), and [Videnovik et al. \(2023\)](#), which emphasise the significance of compatibility between technology, games, and learning objectives.

Thus, this study suggests that GBL can be a relevant learning alternative to increase students' learning motivation in the digital classroom. The primary contribution of this research lies in the context of madrasas equipped with digital facilities, so that GBL can be applied through interactive quiz media such as Quizizz and Kahoot. However, the increase was relatively small. Further research is recommended to use a pretest-posttest control group design, extend the duration of treatment, and examine the influence of GBL on learning outcomes, critical thinking skills, and student engagement in the long term.

CONCLUSION

This study indicates that game-based learning (GBL) has the potential to enhance students' learning motivation in digital madrasah classrooms by providing challenges, immediate feedback, visualisation of achievement, and a more interactive learning experience. Theoretically, the findings support the view that learning motivation develops when students are provided with clear goals, opportunities to participate, rapid responses to their performance, and encouragement to improve their achievement. However, the observed increase in motivation should be interpreted with caution, as this study employed a one-group design without a control group, involved a limited treatment duration, and focused solely on the variable of learning motivation. Future studies are therefore recommended to employ an experimental design with a control group, extend the implementation period, broaden the sample, and examine the effects of GBL on students' learning outcomes, engagement, self-regulation, and critical thinking skills.

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Author's Contributions

The author contributes to the preparation of research ideas and designs, data collection, data analysis, interpretation of research results, and manuscript writing. The final manuscript has been read and approved by the author.

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Conflict of Interest

The authors stated that there was no conflict of interest in this study.

Data Availability

All research data are available to the corresponding author and may be provided if necessary with reasonable request.

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