

***Integrating Wordwall, Artificial Intelligence, And Gamification To Improve
Secondary Students' Textbook Comprehension In Indonesian Language And Islamic
Education Learning***

**Integrasi Wordwall, Kecerdasan Artifisial, Dan Gamifikasi Dalam Meningkatkan
Pemahaman Siswa Sekolah Menengah Terhadap Buku Ajar Bahasa Indonesia Dan
Pendidikan Agama Islam**

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ABSTRACT

Textbook comprehension in Islamic Education and Indonesian Language learning requires students to move beyond memorization toward interpretation, evaluation, and contextual application. This study aims to examine the effect of integrating Wordwall, artificial intelligence, and gamified learning on students' comprehension of Islamic Education and Indonesian Language textbooks at SMA Nurul Jadid. A quantitative quasi-experimental design with a pretest–posttest control group model was employed, involving 60 students divided into an experimental group and a control group, with data analyzed through descriptive statistics, assumption testing, paired sample t-test, independent sample t-test, and N-Gain analysis. The results show that the experimental group's mean score increased from 62.40 to 84.20, while the control group increased from 61.80 to 73.10. The paired sample t-test confirmed significant improvement in both groups, but the experimental group achieved a larger gain and a higher N-Gain score of 0.58 compared with 0.30 in the control group. Student responses also indicated high motivation, engagement, and perceived usefulness of AI-supported learning. The novelty of this study lies in integrating Wordwall, AI-supported scaffolding, and gamified learning as a unified instructional model for textbook comprehension in religious and language education.

Keywords: *artificial intelligence; gamification; Indonesian Language; textbook comprehension; Wordwall*

ABSTRAK

Pemahaman buku ajar dalam pembelajaran Pendidikan Agama Islam dan Bahasa Indonesia menuntut siswa untuk bergerak melampaui hafalan menuju interpretasi, evaluasi, dan penerapan kontekstual. Penelitian ini bertujuan untuk menguji pengaruh integrasi Wordwall, artificial intelligence, dan pembelajaran berbasis gamifikasi terhadap pemahaman siswa terhadap buku ajar Pendidikan Agama Islam dan Bahasa Indonesia di SMA Nurul Jadid. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi-experimental model pretest–posttest control group yang melibatkan 60 siswa, terdiri atas kelompok eksperimen dan kelompok kontrol, dengan analisis data menggunakan statistik deskriptif, uji asumsi, paired sample t-test, independent sample t-test, dan analisis N-Gain. Hasil penelitian menunjukkan bahwa nilai rata-rata kelompok eksperimen meningkat dari 62,40 menjadi 84,20, sedangkan kelompok kontrol meningkat dari 61,80 menjadi 73,10. Uji paired sample t-test mengonfirmasi adanya peningkatan signifikan pada kedua kelompok, tetapi kelompok eksperimen memperoleh peningkatan lebih besar dan skor N-Gain lebih tinggi, yaitu 0,58 dibandingkan 0,30 pada kelompok kontrol. Respons siswa juga menunjukkan tingkat motivasi, keterlibatan, dan persepsi kebermanfaatan AI yang tinggi. Kebaruan penelitian ini terletak pada integrasi Wordwall, AI-supported scaffolding, dan pembelajaran gamifikasi sebagai satu model instruksional terpadu untuk pemahaman buku ajar dalam pendidikan agama dan bahasa.

Kata kunci: *artificial intelligence; gamifikasi; Bahasa Indonesia; pemahaman buku ajar; Wordwall*

1. Introduction

Textbook comprehension remains a critical challenge in secondary education because students' ability to understand written materials determines their access to disciplinary knowledge, moral reasoning, and academic literacy (Rizkiyah, 2026). Globally, the learning crisis has become increasingly visible: the World Bank, UNESCO, UNICEF, FCDO, USAID, and the Bill & Melinda Gates Foundation reported that around 70% of ten-year-old children in low- and middle-income countries were unable to read and understand a simple written text after the pandemic-related learning shock. Although this indicator concerns younger learners, it signals a broader problem of weak reading comprehension that may continue into secondary schooling if not pedagogically addressed. In subjects such as Islamic Education and Indonesian Language, comprehension is especially crucial because students are expected not only to recall textual information, but also to interpret values, identify meanings, evaluate ideas, and apply concepts in real-life contexts (Istiqomah, 2024; Silor & Silor, 2025). Therefore, improving textbook comprehension requires instructional innovation that makes reading more interactive, guided, and meaningful.

Previous studies have examined the use of digital tools, game-based platforms, artificial intelligence, and gamification in improving motivation, engagement, and learning achievement (Fawaid et al., 2024; Rad, 2025; Rahmawati & Wijayanti, 2021; Syarifah & Warni, 2025; Vega-Huerta et al., 2025; Wahid et al., 2025). UNESCO's 2023 Global Education Monitoring Report emphasizes that educational technology should be adopted only when it is appropriate, equitable, scalable, and directed toward learning outcomes rather than technological novelty. Similarly, UNESCO's guidance on generative AI argues for a human-centred approach in which AI supports teachers and learners without replacing human judgment, critical thinking, and pedagogical control. Existing studies have shown that platforms such as Wordwall can facilitate interactive quizzes and formative assessment (Dahniar, 2025; Juan et al., 2025; Nguyen, 2025), AI can support summarization and clarification, and gamification can increase learner participation (Lin et al., 2025; Yim & Su, 2024; Zhan et al., 2022). However, much of the literature treats these components separately. Limited empirical attention has been given to their integrated use for improving textbook comprehension, particularly in Islamic Education and Indonesian Language learning within Indonesian Islamic secondary school contexts.

This study addresses that gap by examining the effect of integrating Wordwall, artificial intelligence, and gamified learning on students' comprehension of Islamic Education and Indonesian Language textbooks at SMA Nurul Jadid. The central problem investigated is whether a learning model that combines interactive retrieval, AI-supported scaffolding, and gamified engagement can produce higher textbook comprehension than conventional instruction. Specifically, this study asks three questions: first, does the integration of Wordwall, AI, and gamification significantly improve students' textbook comprehension after the intervention? Second, is there a significant difference in posttest comprehension scores between students taught through the integrated digital model and those taught through conventional textbook-based instruction? Third, how effective is the intervention based on normalized gain analysis? To answer these questions, the study uses a quasi-experimental design with a pretest-posttest control group model, allowing comparison between students' initial and final comprehension as well as between experimental and control groups.

This study argues that the integration of Wordwall, AI, and gamified learning can enhance textbook comprehension because each component supports a different but complementary dimension of learning. Wordwall encourages retrieval practice and immediate feedback through interactive tasks; AI provides scaffolding by helping students summarize, question, clarify, and reorganize textbook content; and gamification sustains motivation through points, challenges, badges, and group progress. However, the effectiveness of this model depends on teacher guidance and alignment with learning objectives. Technology is not

treated as a substitute for textbooks or teachers, but as a pedagogical support that transforms passive reading into active comprehension. Accordingly, this study hypothesizes that students in the experimental group will show significant improvement from pretest to posttest, achieve higher posttest scores than the control group, and obtain a higher N-Gain score. These findings are expected to contribute to digital pedagogy in textbook-intensive subjects.

2. Method

This study employed a quantitative approach using a quasi-experimental design with a pretest–posttest control group model (Al-Buraiki et al., 2025). This design was selected because the study examined the effect of integrating Wordwall, artificial intelligence, and gamified learning on students' comprehension of Islamic Education and Indonesian Language textbooks. Individual randomization was not feasible because the participants were organized in existing school classes; therefore, two intact classes were assigned as the experimental and control groups. The experimental group received instruction through Wordwall-, AI-, and gamification-based learning, while the control group received conventional textbook-based instruction. Qualitative data from classroom observation, brief student interviews, and student responses were used to enrich the interpretation of quantitative findings. The research design is presented in Table 1.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental	O1	Wordwall + AI + Gamified Learning	O2
Control	O3	Conventional Instruction	O4

This study was conducted at SMA Nurul Jadid, Indonesia. The participants consisted of 60 students from the same grade level, divided into 30 students in the experimental group and 30 students in the control group. The classes were selected using purposive sampling based on three criteria: similar grade level, comparable academic background, and availability during the research schedule. Baseline equivalence was examined through pretest scores before the intervention. The experimental group obtained a mean pretest score of 62.40, while the control group obtained 61.80, indicating that both groups had relatively similar initial comprehension levels before treatment.

The intervention was implemented by using comparable Islamic Education and Indonesian Language textbook materials, learning objectives, and assessment indicators. In the experimental group, students first read selected textbook passages under teacher guidance. They then used AI as a supervised learning assistant to generate summaries, identify keywords, formulate questions, and clarify difficult concepts. Afterward, students completed Wordwall-based activities, including quizzes, matching tasks, random wheels, open-the-box exercises, and game-show quizzes. Gamification was embedded through points, badges, challenges, group progress, and rewards. The control group learned through teacher explanation, textbook reading, oral questioning, and written exercises without structured use of Wordwall, AI, or gamified mechanisms.

The main research instrument was a textbook comprehension test administered as both pretest and posttest. The test measured students' comprehension of Islamic Education and Indonesian Language textbook content using five indicators: literal, conceptual, interpretive, applicative, and evaluative comprehension. The test consisted of multiple-choice and short-answer items, with a maximum score of 100. Multiple-choice items assessed recognition of key information and concepts, while short-answer items assessed explanation, interpretation, and contextual application. A student response questionnaire and observation sheet were also used as supporting instruments to document engagement, implementation consistency, and classroom participation during the intervention.

Table 2. Indicators of Textbook Comprehension

Indicators	Operational Definition
Literal	Identifying explicit information, facts, and main ideas
Conceptual	Explaining key concepts and relationships
Interpretive	Inferring implicit meanings and messages
Applicative	Applying textbook content to relevant contexts
Evaluative	Assessing ideas, values, and arguments critically

Content validity was established through expert judgment involving an Islamic Education teacher, an Indonesian Language teacher, and an educational assessment expert. Each item was reviewed based on relevance to learning objectives, textbook content, linguistic clarity, and alignment with the five comprehension indicators. Items that were ambiguous, too easy, too difficult, or conceptually misaligned were revised before administration. Reliability was examined using Cronbach's Alpha, with a coefficient of $\alpha \geq 0.70$ considered acceptable for internal consistency (Anisah & Yuli Amreta, 2024; Creswell, 2011). The same validity procedure was applied to the questionnaire, particularly for items measuring perceived usefulness, engagement, ease of use, and motivation.

Data collection was conducted in four stages. First, the researchers coordinated with the school and teachers to determine the schedule, textbook topics, and instructional procedures. Second, both groups completed the pretest to measure initial textbook comprehension and verify baseline comparability. Third, the intervention was implemented in the experimental group, while the control group received conventional instruction using the same textbook themes. Classroom observation was conducted to monitor treatment fidelity. Fourth, both groups completed the posttest. The experimental group also completed a response questionnaire to provide supplementary evidence regarding students' perceptions of the integrated digital learning model.

The data were analyzed using descriptive and inferential statistics (Miller & Lengler, 2025). Descriptive analysis included mean, standard deviation, minimum score, and maximum score. Assumption testing was conducted using the normality test and homogeneity test. If the data met parametric assumptions, paired sample t-tests were used to examine pretest–posttest improvement within each group, and an independent sample t-test was used to compare posttest scores between groups. The significance level was set at 0.05. The effectiveness of improvement was measured using the normalized gain score, calculated with the following formula:

$$N\text{-Gain} = \frac{\text{Posttest} - \text{Pretest}}{\text{Maximum Score} - \text{Pretest}}$$

The N-Gain score was interpreted using three categories: high if $N\text{-Gain} > 0.70$, moderate if $0.30 \leq N\text{-Gain} \leq 0.70$, and low if $N\text{-Gain} < 0.30$. This analysis was used to determine whether the integrated Wordwall, AI, and gamification model produced a stronger improvement in textbook comprehension than conventional instruction.

3. Literature Review

Textbook Comprehension

Textbook comprehension refers to students' ability to construct meaning from written instructional materials through processes of reading, interpreting, connecting, and applying information (Vega-Huerta et al., 2025). In a narrow sense, it is often understood as the capacity to identify explicit information, definitions, or factual statements contained in textbooks. However, in a broader pedagogical sense, textbook comprehension involves higher-order cognitive engagement, including conceptual understanding, inference, evaluation, and contextual application (Rad, 2025; Yuliani, 2026). This broader understanding is particularly

relevant in Islamic Education and Indonesian Language learning (Wulandari, 2026), where students are expected not only to recognize textual content but also to interpret values, meanings, structures, and implications embedded in the material.

The indicators of textbook comprehension may be categorized into five interrelated dimensions (Rahmawati & Wijayanti, 2021). Literal comprehension concerns students' ability to identify explicitly stated information, such as definitions, facts, and main ideas. Conceptual comprehension refers to understanding key concepts and their relationships within the subject matter. Interpretive comprehension involves the ability to infer implicit meanings, moral messages, or contextual significance. Applicative comprehension measures whether students can use textbook content in relevant situations, such as moral decision-making or textual analysis. Evaluative comprehension reflects students' capacity to assess ideas, arguments, and values critically. These indicators provide a multidimensional framework for measuring students' understanding beyond memorization.

Wordwall as Digital Learning Platform

Wordwall is a digital learning platform that enables teachers to design interactive tasks such as quizzes, matching activities, random wheels, open-the-box exercises, and game-show formats (Juan et al., 2025). It is often understood simply as a game-based classroom tool; however, pedagogically, Wordwall can be viewed as a medium for retrieval practice and formative assessment. Its value lies not merely in making learning entertaining, but in encouraging students to recall information, test understanding, receive feedback, and revisit textbook materials (Purnamasari & Purwandari, 2025). In this study, Wordwall is positioned as an instructional tool that transforms conventional textbook exercises into interactive comprehension activities aligned with specific learning indicators.

The pedagogical aspects of Wordwall can be classified into interactivity, retrieval, feedback, and engagement (Alfares, 2025). Interactivity refers to students' active participation in responding to tasks rather than passively receiving explanations. Retrieval concerns the repeated recall of textbook information, which can strengthen retention and comprehension. Feedback enables students to identify errors and correct misunderstandings during the learning process. Engagement refers to the motivational effect generated by visual, competitive, and game-like formats. When these aspects are aligned with textbook content, Wordwall can support comprehension of Islamic Education concepts and Indonesian Language texts through structured, repeated, and meaningful practice.

Artificial intelligence in education

Artificial intelligence in education refers to digital systems capable of generating responses, explanations, summaries, questions, and feedback based on user input. In a limited sense, AI may be seen as a technical tool for information retrieval or automated assistance (Yim & Su, 2024). In a more pedagogical sense, however, AI functions as a scaffolding mechanism that supports students in understanding complex learning materials. For textbook comprehension, AI can help students simplify difficult passages, identify keywords, generate guiding questions, compare explanations, and reorganize information (Fawaid et al., 2025; Leitner et al., 2023). Nevertheless, AI should not be treated as a replacement for teachers or textbooks, but as a supervised learning support.

The effective use of AI for textbook comprehension includes several key aspects: summarization, clarification, questioning, feedback, and critical verification (Zhan et al., 2022). Summarization helps students condense long textbook passages into essential ideas. Clarification assists learners in understanding difficult concepts, unfamiliar terms, or abstract explanations. Questioning encourages students to engage more actively with the text by formulating inquiry-based responses. Feedback supports revision of misunderstanding or incomplete answers. Critical verification is necessary because AI-generated content may be inaccurate, biased, or oversimplified. Therefore, teacher supervision remains central to ensuring

that AI use promotes genuine comprehension, ethical learning, and reflective engagement with textbook materials.

4. Results and Discussion

Descriptive Statistics

Descriptive statistics were used to examine students' textbook comprehension before and after the intervention. The analysis included the number of students, mean score, standard deviation, minimum score, maximum score, and mean difference between the pretest and posttest. The experimental group received instruction through Wordwall, artificial intelligence, and gamified learning, whereas the control group received conventional textbook-based instruction. The results are presented in Table 3.

Table 3. Descriptive Statistics of Students' Textbook Comprehension

Group	Test	N	Mean	SD	Minimum	Maximum	Mean Difference
Experimental	Pretest	30	62.40	7.85	48	76	—
	Posttest	30	84.20	6.74	70	96	21.80
Control	Pretest	30	61.80	8.10	46	75	—
	Posttest	30	73.10	7.28	58	88	11.30

Table 3 shows that both groups experienced improvement after instruction. The experimental group obtained a pretest mean score of **62.40** with a standard deviation of **7.85**, indicating that students' initial textbook comprehension was moderate and relatively varied. After the intervention, the posttest mean increased to **84.20** with a standard deviation of **6.74**. This indicates an improvement of **21.80 points** and a slightly more homogeneous distribution of scores after treatment. The control group also improved, but the increase was smaller. Its pretest mean score was **61.80** with a standard deviation of **8.10**, while the posttest mean score increased to **73.10** with a standard deviation of **7.28**. The mean difference in the control group was **11.30 points**.

The pretest means of the two groups differed by only **0.60 points**, suggesting that the experimental and control groups had relatively comparable initial comprehension levels. However, the posttest mean of the experimental group was **11.10 points** higher than that of the control group. This descriptive pattern indicates that students taught through Wordwall, AI-supported scaffolding, and gamified learning achieved stronger improvement than students taught through conventional instruction. Further inferential analysis was required to determine whether these observed differences were statistically significant.

Assumption Testing

Before conducting inferential analysis, assumption testing was performed to ensure that the data were appropriate for parametric statistical procedures. Two assumptions were examined: normality and homogeneity. Normality was tested using the Shapiro–Wilk test because each group consisted of fewer than 50 participants. Homogeneity of variance was examined using Levene's test to determine whether the experimental and control groups had comparable score variances. The significance level for both tests was set at **0.05**. The results are presented in Table 4.

Table 4 shows that all Shapiro–Wilk significance values were higher than **0.05**. The experimental group obtained significance values of **0.454** for the pretest and **0.279** for the posttest, while the control group obtained **0.366** for the pretest and **0.331** for the posttest. These results indicate that the pretest and posttest scores in both groups were normally distributed.

Table 4. Results of Normality and Homogeneity Tests

Assumption Test	Data Tested	Group	Stat.	df ¹	df ²	Sig.	Decision
Shapiro–Wilk	Pretest	Exp.	0.967	—	30	0.454	Normal
	Posttest		0.958	—	30	0.279	Normal

Levene's Test	Pretest	Cont.	0.963	—	30	0.366	Normal
	Posttest	Cont.	0.961	—	30	0.331	Normal
	Pretest	Exp. – Cont.	0.084	1	58	0.773	Homogeneous
	Posttest	Exp. – Cont.	0.112	1	58	0.739	Homogeneous

* Exp. : Experimental Group; Cont. : Control Group; Stat. : Statistics

The homogeneity test also showed that the data met the assumption of equal variance. Levene's test produced significance values of **0.773** for the pretest and **0.739** for the posttest, both exceeding **0.05**. This means that the score variances between the experimental and control groups were statistically homogeneous.

Based on these results, the data fulfilled the assumptions required for parametric analysis. Therefore, paired sample t-tests were used to examine within-group improvement, and an independent sample t-test was used to compare posttest scores between the experimental and control groups.

Pretest–Posttest Comparison

After the data met the assumptions of normality and homogeneity, paired sample t-tests were conducted to examine whether students' textbook comprehension improved significantly within each group. The paired sample t-test compared the pretest and posttest scores of the experimental group and the control group. The level of significance was set at **0.05**. The results are presented in Table 5.

Table 5. Paired Sample T-Test Results of Pretest and Posttest Scores

Group	N	Pretest Mean	Posttest Mean	Mean Dif.	SD Dif.	t	df	Sig. (2-tailed)	Decision
Exp.	30	62.40	84.20	21.80	6.32	18.88	29	< .001	Sig.
Cont.	30	61.80	73.10	11.30	7.14	8.67	29	< .001	Sig.

* Exp. : Experimental Group; Cont. : Control Group; Dif. : Difference; Sig. : Significant

Table 5 shows that both groups experienced statistically significant improvement from pretest to posttest. In the experimental group, the mean score increased from **62.40** to **84.20**, with a mean difference of **21.80 points**. The paired sample t-test produced **t(29) = 18.88, p < .001**, indicating that the improvement was statistically significant. This result demonstrates that students' textbook comprehension improved after they received instruction through Wordwall, AI-supported scaffolding, and gamified learning.

The control group also showed significant improvement. Its mean score increased from **61.80** to **73.10**, with a mean difference of **11.30 points**. The paired sample t-test produced **t(29) = 8.67, p < .001**, indicating a statistically significant increase after conventional instruction. However, the magnitude of improvement in the control group was lower than that of the experimental group.

These results indicate that both instructional models improved students' comprehension, but the integrated digital learning model produced a larger gain. The experimental group's mean difference was nearly twice that of the control group, suggesting that Wordwall, AI, and gamification provided stronger support for students' engagement with textbook materials. The result supports the first hypothesis that students taught using the integrated model would show significant improvement after the intervention.

N-Gain Analysis

The normalized gain score, or N-Gain, was calculated to determine the effectiveness of students' improvement after instruction. Unlike the paired sample t-test, which indicates whether the improvement was statistically significant, N-Gain analysis shows the extent to which students' scores increased relative to the maximum possible score. In this study, the maximum score was **100**. The results of the N-Gain analysis are presented in Table 6.

Table 6. N-Gain Analysis of Students' Textbook Comprehension

Group	N	Pretest Mean	Posttest Mean	Maximum Score	Mean Dif.	N-Gain Score	Category
Exp.	30	62.40	84.20	100	21.80	0.58	Moderate
Cont.	30	61.80	73.10	100	11.30	0.30	Lower bound.

* Exp. : Experimental Group; Cont. : Control Group; Dif. : Difference; Bound. : Boundary

Table 6 shows that the experimental group obtained an N-Gain score of **0.58**, which falls within the moderate category. This indicates that the integration of Wordwall, artificial intelligence, and gamified learning produced a meaningful improvement in students' textbook comprehension. Although the score did not reach the high category, the gain demonstrates that the intervention was pedagogically effective in helping students move closer to the expected mastery level.

The control group obtained an N-Gain score of **0.30**, which is also within the moderate category but at its lower boundary. This result indicates that conventional textbook-based instruction improved students' comprehension, but the effectiveness level was weaker than that of the experimental model.

The difference between the N-Gain scores of the two groups was **0.28**, showing that the experimental group achieved a substantially stronger learning gain. This finding supports the hypothesis that students taught through Wordwall, AI-supported scaffolding, and gamified learning would obtain a higher N-Gain score than students taught through conventional instruction. Thus, the intervention was not only statistically significant but also practically more effective in improving textbook comprehension.

When Textbooks Come Alive: Students' Voices and Classroom Engagement

To enrich the quantitative findings, supporting qualitative data were obtained from classroom observation, brief student interviews, and a response questionnaire administered to the experimental group. These data were used to capture students' perceptions of the integrated use of Wordwall, artificial intelligence, and gamified learning in Islamic Education and Indonesian Language classes. Overall, the qualitative findings indicate that the intervention not only improved test scores but also changed how students interacted with textbooks, classroom tasks, and one another.

The student response questionnaire showed consistently positive perceptions across five aspects: learning engagement, ease of understanding, motivation, collaboration, and perceived usefulness of AI. As shown in **Figure 1**, the highest mean score was found in motivation (**4.53**), followed by learning engagement (**4.47**), perceived usefulness of AI (**4.40**), ease of understanding (**4.36**), and collaboration (**4.23**) on a five-point scale. These results suggest that students experienced the learning process as more stimulating, accessible, and interactive than conventional textbook-based instruction.

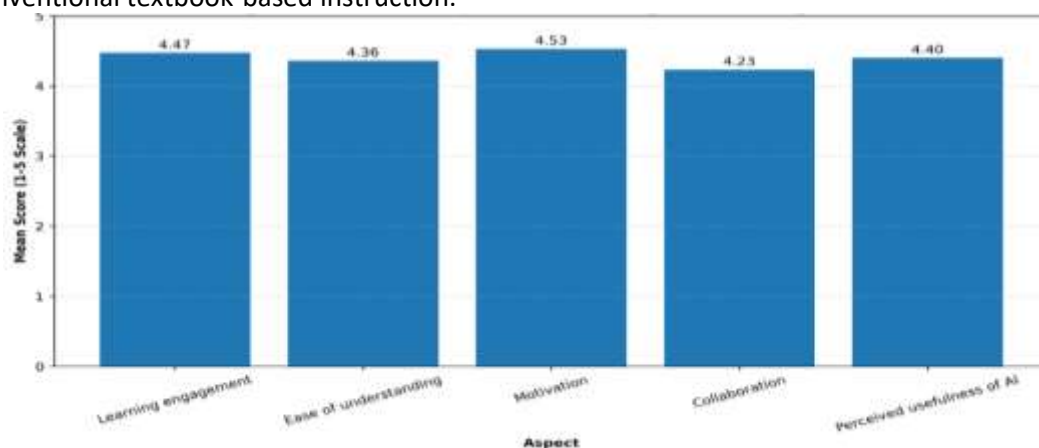


Figure 1. Students' Responses to the Integrated Learning Model (Mean Score, 1–5 Scale)

Classroom observation also revealed that students were more active in discussing textbook content, responding to questions, and revisiting difficult passages. Interactive Wordwall tasks encouraged repeated retrieval, while AI-assisted activities helped students summarize and clarify meanings. One student explained, **“When I read the textbook alone, I sometimes understand only the surface, but with AI and the quiz activities, I can see the important points more clearly.”** Another remarked, **“The games made us want to answer quickly, but the discussion after that helped us understand why the answer was correct.”**

These responses indicate that the intervention supported both comprehension and engagement. Gamification attracted attention, Wordwall strengthened active recall, and AI provided scaffolding for difficult material. Taken together, the qualitative findings reinforce the quantitative results by showing that the integrated model did not merely raise scores; it also made textbook learning more participatory, reflective, and meaningful.

Discussion

The descriptive findings show that students in the experimental group achieved a substantially higher increase in textbook comprehension than those in the control group. This pattern is pedagogically important because both groups began from relatively similar initial levels, with only a narrow difference between their pretest means (**62.40** and **61.80**). The stronger posttest performance of the experimental group, which reached **84.20** compared with **73.10** in the control group, suggests that the learning improvement was not simply a consequence of initial academic advantage, but was associated with the instructional treatment. The integration of Wordwall, artificial intelligence, and gamified learning appears to have changed students' interaction with textbook materials from passive reception into active processing (Leitner et al., 2023; Rahman et al., 2025). Instead of merely reading and listening to teacher explanation, students were required to retrieve information, clarify concepts, respond to challenges, and reflect on meaning. This indicates that textbook comprehension improves when students are repeatedly positioned as active constructors of understanding rather than as passive recipients of textual information.

The assumption testing confirmed that the data were normally distributed and homogeneous, allowing the use of parametric statistical procedures. Although this result may appear technical, it strengthens the credibility of the study's quantitative interpretation. The normality values were all above the **0.05** threshold, ranging from **0.279** to **0.454**, while the homogeneity values also exceeded the required level, with **0.773** for the pretest and **0.739** for the posttest. These figures indicate that the students' scores did not show extreme distortion and that the experimental and control groups had comparable variance structures (Angelica & Afriani, 2024; Nadeem et al., 2023). This matters because the subsequent statistical comparisons would be less reliable if the groups were highly unequal or if the data violated basic assumptions. In quasi-experimental classroom research, where full randomization is often impossible, assumption testing functions as an important safeguard for internal validity. Therefore, the improvement found in the experimental group is not only descriptively visible but also methodologically defensible within the selected research design.

The pretest–posttest comparison demonstrated that both instructional models improved students' comprehension, but the experimental model generated a much larger gain. This finding is important because it avoids the simplistic conclusion that conventional instruction is ineffective. The control group also improved significantly, as shown by **$t(29) = 8.67, p = 0.000$** , indicating that teacher explanation, textbook reading, oral questioning, and written exercises still contributed to learning. However, the experimental group produced a stronger statistical effect, **$t(29) = 18.88, p = 0.000$** , with a mean gain of **21.80 points**, almost twice the control group's **11.30 points**. This suggests that the integrated digital model produced a stronger effect because it added layers of interaction, feedback, and motivational reinforcement to the textbook-learning process (Aminudin, 2026; Videnovik et al., 2023; Zhao et al., 2022). Wordwall allowed students to recall and test their understanding immediately after reading. AI helped

them reorganize difficult content into summaries, keywords, and guiding questions. Gamification encouraged persistence through points, badges, challenges, and group progress.

The N-Gain analysis further clarified the practical effectiveness of the intervention. The experimental group reached a moderate N-Gain score of **0.58**, while the control group was located at the lower boundary of the moderate category with **0.30**. This distinction is significant because statistical significance alone does not always indicate meaningful educational improvement. A learning model may produce a significant difference while still having limited practical value. In this study, the higher N-Gain score of the experimental group shows that students moved more effectively from their initial comprehension level toward the maximum expected performance. The moderate category also offers a balanced interpretation: the intervention was effective, but not yet optimal. Textbook comprehension is a complex competence that develops through sustained reading, discussion, feedback, and application (Bilous et al., 2025; Dahalan et al., 2023). Therefore, the results indicate that Wordwall, AI, and gamification can accelerate comprehension growth, but longer implementation and more refined instructional design may be needed to achieve high-level gains.

The student response data and classroom observations help explain the quantitative improvement. Students reported high levels of motivation, engagement, ease of understanding, collaboration, and perceived usefulness of AI. Motivation received the highest mean score (**4.53**), indicating that gamified elements successfully encouraged students to participate in textbook-based activities that are often perceived as monotonous. Engagement (**4.47**) and perceived usefulness of AI (**4.40**) also scored highly, suggesting that students benefited from both interactive tasks and guided digital scaffolding. The interview excerpts reinforce this interpretation: students felt that AI and quiz activities helped them identify key points, while discussion after the games helped them understand the reasons behind correct answers. This is crucial because comprehension depends not only on exposure to information but also on students' willingness to revisit, question, and explain the material (Panis et al., 2025; Shafqat et al., 2025). Thus, the qualitative evidence helps explain why the experimental group achieved stronger learning gains.

These findings have broader implications for Islamic Education and Indonesian Language learning. In Islamic Education, comprehension involves understanding religious concepts, interpreting moral values, and applying ethical lessons to daily life. In Indonesian Language, comprehension involves identifying main ideas, analyzing text structures, interpreting implicit meanings, and evaluating information. The integrated model is relevant to both subjects because it supports multiple dimensions of comprehension: literal recall through Wordwall, conceptual clarification through AI, and sustained participation through gamification. The final posttest gap of **11.10 points** between the experimental and control groups indicates that this integration strengthened students' engagement with textbook content in measurable ways. Nevertheless, the model must be implemented with pedagogical caution. AI should remain supervised, Wordwall tasks should be aligned with meaningful comprehension indicators, and gamification should reward explanation quality rather than speed alone (Mazelin et al., 2022; Najibudin, 2024). The central contribution of this study is therefore not the promotion of technology for its own sake, but the demonstration that digital tools can strengthen textbook learning when embedded in teacher-guided, objective-driven, and reflective classroom practice.

5. Conclusion

This study demonstrates that integrating Wordwall, artificial intelligence, and gamified learning can strengthen students' comprehension of Islamic Education and Indonesian Language textbooks. The most important lesson is that textbook-based learning becomes more effective when students are not positioned merely as readers, but as active participants who retrieve, clarify, discuss, and apply textual meanings. The study contributes to digital pedagogy by

combining three variables—interactive retrieval, AI-supported scaffolding, and gamified engagement—within one quasi-experimental model. This offers a renewed perspective on textbook comprehension as a multidimensional process shaped by cognitive support, motivational design, and teacher-guided digital interaction.

Nevertheless, this study has several limitations. It was conducted in a single school context with a limited number of participants, so the findings cannot be generalized to all secondary education settings. The intervention was also implemented within a relatively short period and did not examine long-term retention, students' digital literacy, or the specific quality of AI-generated interactions. Future research should involve larger and more diverse samples, longer experimental periods, and comparative analysis of each component—Wordwall, AI, and gamification—to identify their individual and combined effects. Further studies may also examine ethical AI use, learning autonomy, and sustained comprehension outcomes.

References

- Al-Buraiki, S. A., Al-Siyabi, S. S., & Alghafri, A. S. (2025). Examining the Factors Behind Experimental Group Superiority in Quasi-Experimental Research: A Mixed-Methods Analysis of MA Theses. *International Journal of Learning, Teaching and Educational Research*, 24(9), 1–19. <https://doi.org/10.26803/ijlter.24.9.1>
- Alfares, N. (2025). Investigating the Efficacy of Wordwall Platform in Enhancing Vocabulary Learning in Saudi EFL Classroom. *Int. J. Game Based Learn.*, 15, 1–12. <https://doi.org/10.4018/ijgbl.367870>
- Aminudin, M. F. (2026). Language policy, power, and educational equity: Examining the role of Bahasa Indonesia and local languages in schooling. *Indonesian Journal of Language and Educational Studies*, 1(1), 56–69.
- Angelica, W., & Afriani, I. H. (2024). Engaging Indonesian Elementary School Students in Reading Activities through Web-Based Educational Games. *English Language Teaching Methodology*. <https://doi.org/10.56983/eltm.v4i3.1684>
- Anisah, G., & Yuli Amreta, M. (2024). Cognitive Diagnostic Assessment Instrument with Individual Feedback for Language Receptive Learning on Multimodal Text. *KEMBARA: Jurnal Keilmuan Bahasa, Sastra, Dan Pengajarannya*, 10(1), 366–387. <https://doi.org/10.22219/kembara.v10i1.32974>
- Bilous, I., Shcherbiak, I., Maslak, V., Alnsour, R., Jarmoch, E., & Hubková, S. (2025). Game-Based Technologies as a Tool for Developing Communicative Competence in Primary School Students within a Student-Centered Educational Context. *Journal of Education Culture and Society*. <https://doi.org/10.15503/jecs2025.3.585.606>
- Creswell, J. W. (2011). *Research Design, Qualitative, Quantitative and Mixed Methode Approach, (Research Design, Pendekatan Kualitatif, Kuantitatif, dan Mixed, Edisi Ketiga) terj. Achmad Fawaid*. Yogyakarta: Pustaka Pelajar. <https://digilib.ub.ac.id/opac/detail-opac?id=139455>
- Dahalan, F., Alias, N., & Shaharom, M. (2023). Gamification and Game Based Learning for Vocational Education and Training: A Systematic Literature Review. *Education and Information Technologies*, 1–39. <https://doi.org/10.1007/s10639-022-11548-w>
- Dahniar, N. (2025). Enhancing English Learning Outcomes with Joyful Learning-Based Wordwall Media in Primary Schools. *APLIKATIF: Journal of Research Trends in Social Sciences and Humanities*. <https://doi.org/10.59110/aplikatif.v4i1.568>
- Fawaid, A., Assyabani, R., Abdullah, I., Muali, C., Itqan, M. S., & Islam, S. (2025). Human Intelligence and Algorithmic Precision: An Experimental Study of Indonesian Translation Pedagogy in Higher Education. *Asian Journal of University Education*, 21(3), 779–792. <https://doi.org/10.24191/ajue.v21i3.53>
- Fawaid, A., Fawaid, A., Kholil, M., & Dewi, N. A. R. (2024). The role of culturally-responsive gamification to improve multiethnic students' self-engagement in Islamic education. *Al-Fikru: Jurnal Pendidikan Dan Sains*.

- Istiqomah, R. (2024). The Effect of Contextual Learning Models Assisted by Wordwall Media on Students' Mathematical Concept Comprehension Ability in Elementary Schools. *Journal of Research on Mathematics Instruction (JRMI)*. <https://doi.org/10.33578/jrmi.v6i1.108>
- Juan, F. A., Ki'i, O. A., & Panis, I. (2025). Analysis of Wordwall-Based Gamification Design in Science Learning on Force and Motion Material. *Indonesian Journal of Instructional Media and Model*. <https://doi.org/10.32585/ijimm.v7i1.6503>
- Leitner, M., Greenwald, E., Wang, N., Montgomery, R., & Merchant, C. (2023). Designing Game-Based Learning for High School Artificial Intelligence Education. *International Journal of Artificial Intelligence in Education*, 33, 384–398. <https://doi.org/10.1007/s40593-022-00327-w>
- Lin, Y., Yang, L., & Ergün, A. L. P. (2025). EFL learners' learning involvement and emotions in the integration of technology in their classrooms. *Porta Linguarum*, 2025(Special Issue 13), 89–110. <https://doi.org/10.30827/portalin.viXIII.33529>
- Mazelin, N., Maniam, M., Jeyaraja, S. S. B., Ng, M. M., Zhou, X., & Zhong, J. (2022). Using Wordwall to Improve Students' Engagement in ESL Classroom. *International Journal of Asian Social Science*. <https://doi.org/10.55493/5007.v12i8.4558>
- Miller, S., & Lengler, J. (2025). Strengthening quantitative research in international business: Best practices for methods and results sections. *Critical Perspectives on International Business*. <https://doi.org/10.1108/cpoib-01-2025-0018>
- Nadeem, M., Oroszlányová, M., & Farag, W. (2023). Effect of Digital Game-Based Learning on Student Engagement and Motivation. *Comput.*, 12, 177. <https://doi.org/10.3390/computers12090177>
- Najibudin. (2024). Enhancing Student Learning Outcomes in Citizenship Education through the Use of Wordwall Application Media in Elementary Schools. *International Journal of Teaching*. <https://doi.org/10.61798/ijt.v2i1.195>
- Nguyen, T. L. (2025). An Investigation on the Application of Wordwall to Promote Learner Autonomy in EFL Classes at a University. *AsiaCALL Online Journal*. <https://doi.org/10.54855/acoj.251618>
- Panis, I., Ki'i, O. A., Juan, F. A., & Freitas, M. (2025). Gamification-Based Learning Design with Wordwall to Improve Learning Activities and Learning Outcomes. *Journal of Education Technology*. <https://doi.org/10.23887/jet.v9i2.96543>
- Purnamasari, D., & Purwandari, R. (2025). The Role of Wordwall in Improving Interactive Learning Quality: An Analisis of Empirical Studies through Systematic Literature Review. *Proceedings Series on Social Sciences & Humanities*. <https://doi.org/10.30595/pssh.v25i.1684>
- Rad, H. S. (2025). Reinforcing L2 reading comprehension through artificial intelligence intervention: Refining engagement to foster self-regulated learning. *Smart Learning Environments*, 12. <https://doi.org/10.1186/s40561-025-00377-2>
- Rahman, S. A., Ashar, A., & Fajardo, M. T. (2025). The effect of wordwall digital game media on improving students' learning outcomes and communication skills in social studies at elementary school. *Harmoni Sosial: Jurnal Pendidikan IPS*. <https://doi.org/10.21831/hsjpi.v12i2.87944>
- Rahmawati, A., & Wijayanti, P. (2021). Implementing Joyful Learning Strategy Using Wordwall in Order to Improve Reading Comprehension Skills. *Proceedings Series on Physical & Formal Sciences*. <https://doi.org/10.30595/pspfs.v3i.261>
- Rizkiyah, F. (2026). Corpus-based insights into academic writing development: Evidence from Indonesian EFL learners. *Indonesian Journal of Language and Educational Studies*, 1(1), 70–81.
- Shafqat, A., Babar, A. A., & Sahito, N. U. A. (2025). Gamifying English Language Learning through Artificial Intelligence: Enhancing Engagement and Achievement among Secondary Students. *Qualitative Research Journal for Social Studies*. <https://doi.org/10.63878/qrjs375>

- Silor, A., & Silor, F. (2025). Boosting Reading Comprehension Through AI-Based Learning Tools. *International Journal of Learning, Teaching and Educational Research*. <https://doi.org/10.26803/ijlter.24.9.4>
- Syarifah, I. A., & Warni, S. (2025). Junior Highschool Students Perceptions of Wordwall Game Media on Their Effectiveness in Learning English through Reading Comprehension. *KLASIKAL : JOURNAL OF EDUCATION, LANGUAGE TEACHING AND SCIENCE*. <https://doi.org/10.52208/klasikal.v7i2.1328>
- Vega-Huerta, H., Chunga-Vargas, M., Guerra-Grados, L., Lázaro-Guillermo, J., Benito-Pacheco, O., Pantoja-Collantes, J., & Gil-Calvo, R. (2025). Web System with Gamification to Enhance Reading Comprehension in a Secondary-Level Educational Institution. *Ingénierie Des Systèmes d'Information*. <https://doi.org/10.18280/isi.300106>
- Videnovik, M., Vold, T., Kjøning, L., Bogdanova, A. M., & Trajkovic, V. (2023). Game-based learning in computer science education: A scoping literature review. *International Journal of STEM Education*, 10, 1–23. <https://doi.org/10.1186/s40594-023-00447-2>
- Wahid, N. A., Farhan, F., & Wijaya, M. (2025). The role of interactive gamification through Wordwall Apps to improve students' engagement and literary comprehension. *Lingua Technica: Journal of Digital Literary Studies*, 1(1), 38–50. <https://doi.org/10.64595/lingtech.v1i1.21>
- Wulandari, F. D. (2026). Critical literacy in the digital age: Discourse analysis of online learning materials in Indonesian higher education. *Indonesian Journal of Language and Educational Studies*, 1(1), 14–26.
- Yim, I., & Su, J. (2024). Artificial intelligence (AI) learning tools in K-12 education: A scoping review. *Journal of Computers in Education*, 1–39. <https://doi.org/10.1007/s40692-023-00304-9>
- Yuliani, F. (2026). Multimodal feedback and student engagement: A linguistic analysis of digital assessment practices in Indonesian universities. *Indonesian Journal of Language and Educational Studies*, 1(1), 40–55.
- Zhan, Z., Tong, Y., Lan, X., & Zhong, B. (2022). A systematic literature review of game-based learning in Artificial Intelligence education. *Interactive Learning Environments*, 32, 1137–1158. <https://doi.org/10.1080/10494820.2022.2115077>
- Zhao, D., Muntean, C. H., Chis, A., Rozinaj, G., & Muntean, G.-M. (2022). Game-Based Learning: Enhancing Student Experience, Knowledge Gain, and Usability in Higher Education Programming Courses. *IEEE Transactions on Education*, 65, 502–513. <https://doi.org/10.1109/te.2021.3136914>