

## The Influence of Game-Based Learning Assisted by Wordwall on Informatics Learning Outcomes

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### ABSTRACT

The research was conducted with the aim of knowing the difference in the effect of the application of game-based learning assisted by Wordwall on the learning outcomes of the informatics class VII SMP Negeri 3 Colomadu. The design of this research is a quasi-experiment. The population used was all seventh-grade students of SMP Negeri 3 Colomadu. The sampling technique used was cluster random sampling, so that the samples used were 32 students from class VII A as the experimental class group and 32 students from class VII B as the control class group. The technique used is by giving tests which include a pretest and a posttest. Prerequisite test by doing the normality test with the Kolmogorov-Smirnov and the homogeneity test with Levene. Data analysis is by independent sample t-test and paired sample t-test with a significant value limit of 0.05 and N-Gain Score, with the help of the SPSS 25 application program. The results obtained show that there is an influence on the application of game-based learning aided by Wordwall on the learning outcomes of the informatics class VII SMP Negeri 3 Colomadu. It can be seen from the calculation of the independent sample t-test, which shows a significance value of  $0.036 < 0.05$ , and the paired sample t-test results show a value of  $0.000 < 0.05$ . These results show that the use of game-based learning assisted by Wordwall has an effect on learning outcomes. The results on the N-Gain Score also show that the score obtained by the experimental group is higher than the control group, namely  $0.4212 > 0.1630$ . From these results, the experimental group obtained a score that is moderate. These findings suggest that digitally gamified review platforms can serve as effective pedagogical supplements in technology-integrated classrooms, warranting further investigation across diverse subject areas and school contexts.

**Keywords:** Game-based learning, Wordwall, Quasi-experimental design, Informatics education, Student achievement.

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## 1. INTRODUCTION

Current advances in technology have caused its use to play an indispensable role in all areas of life. The rapid technological advances that have occurred have also had an impact on learning, which is becoming increasingly widespread in various educational institutions. According to Nur'Aini (2018), education plays an important role in learning when it can be carried out well if it is structured and planned. By organizing and planning learning, it is hoped that the nation's generation will be able to follow and compete in an era that involves technology (Hashim et al., 2022). As technology advances today, as a teacher, you are required to adapt quickly to any situation and be able to utilize technology to develop learning according to current conditions (Chitsauko Muyambi & Ziphorah Ramorola, 2025).

Seeing the reality, education in Indonesia is currently experiencing problems in applying technology to the learning process, which results in less-than-optimal student learning outcomes (Ahmad et al., 2024). There are still many lessons that occur with one-way communication, which is dominated by the teacher, making the classroom atmosphere tend to be boring because it does not involve students in the learning that occurs. This is a concern for teachers to determine suitable learning media for the continuity of learning. By choosing to learn media that is suitable

for students, it certainly has an impact when learning takes place; students tend to pay attention and reduce boredom. The problems that arise are the result of increasingly rapid developments and have an impact on the world of education.

causing learning problems. Other learning problems also occur during the learning process, namely as a result of the misuse of gadgets and social networks. As explained by (Amez & Baert, 2020) Students lack concentration due to the use of smartphones in class, and some students use smartphones for activities outside the learning process, such as chatting, watching videos, playing on social media, and so on. There needs to be innovation from teachers, such as by implementing learning models that are used appropriately to build a learning environment that is fun, dialogical, creative, and dynamic, so that learning takes place as expected and can maximize student learning outcomes.

Learning outcomes can be used as a reference during learning because they can provide information to the teacher regarding each student's progress in realizing their learning goals through the future learning process (Nurvidia & Yulianto, 2024). Obtaining learning outcomes is supported by the achievements obtained by students academically through exams and assignments given, and being active in asking and answering questions (NasirpourOsgoei & Obembe, 2025). Efforts that can be made by teachers to improve the quality of student learning are by utilizing technological media in the learning process. One of the technological innovations that can be applied in the learning process is game-based learning.

The existence of a game-based learning process certainly makes it easier for teachers to innovate and develop learning methods that are applied to students so that they can improve the quality of learning. According (Gundersen Lampropoulos (2025) digital games have been proven to be able to change the educational learning process because of their benefits in supporting ongoing learning by giving students the opportunity to do things that usually can only be done outside the school environment, and involve many subjects. The use of game-based learning helps students to learn effectively. A more fun and interactive method, so that it can improve the quality of learning.

One of the innovative and more varied learning media is Wordwall. Wordwall is a type of game based on a digital learning platform that can motivate students in the material presented, can also increase students' competitiveness and way of thinking when understanding the material and offers various features to enrich learning and learning media that allows teachers to create various interactive activities such as crossword puzzle, games and quizzes that can be used as innovation in learning. As explained by (Rahman et al., 2025) The use of Wordwall media has been used in the learning process in various countries where the quality of learning is improving. One subject that is suitable for this method is informatics lessons. Informatics lessons are subjects with a high enough mastery of information technology to be able to compete in the era of globalization. According to (Samin et al., 2022), Informatics lessons are not just about learning various computer software, but also problem-solving and critical thinking. Informatics is a field that moves fast and continues to develop, so students need to master the basic concepts of informatics to prepare for an increasingly digital future. Therefore, the use of game-based learning and Wordwall-assisted learning media in informatics learning is expected to maximize student learning outcomes. Therefore, this study aims to examine the effect of Wordwall-assisted game-based learning on Grade 7 informatics learning outcomes through a quasi-experimental design. This study contributes to the empirical literature by providing the first controlled comparison of Wordwall-mediated GBL against conventional lecture instruction in an Indonesian junior secondary informatics context.

## 2. RESEARCH METHOD

The method used in this research is a quantitative approach with experimental methods. Meanwhile, the design used is a quasi-experimental design with a Non-Equivalent Control Group Design research pattern. The population used in this research was class VII students of SMP Negeri 3 Colomadu, Karanganyar Regency. So this research sample uses two classes, namely the experimental class and the control class. The experimental class was taken from class VII A with a total of 32 students, and the control class was taken from class VII B, with a total of 32 students. The experimental class will be given a game-based learning method assisted by Wordwall, while the control class will use the lecture method assisted by PowerPoint. The following is the appearance of Wordwall as a learning medium used in the experimental class:



Figure 1. The initial view of the Wordwall assignment

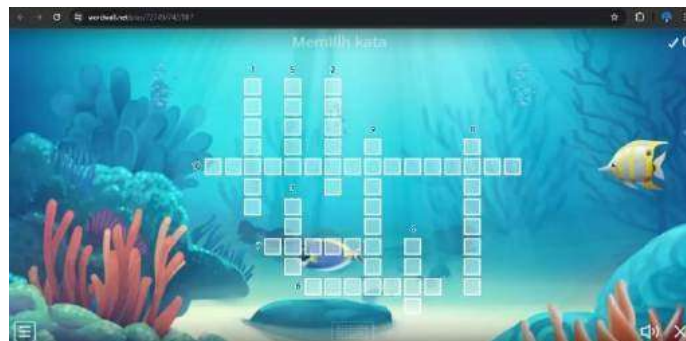


Figure 2. Task view on Wordwall

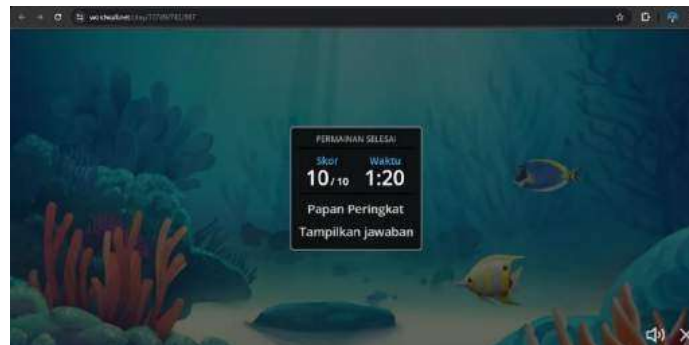


Figure 3. The final view of the Wordwall task

The research instrument that will be used in this research is in the form of test questions consisting of the same pretest and post test with different treatments to determine student learning outcomes. The tests given are previously tested for validity and reliability to determine whether the questions used are suitable for testing. The form of research design used in this research is:

Table 1. Research Design

Kelompok	Pretest	Treatment	Post test
Control	E1	X1	E2
Experimental	E2	X2	E2

E1 = Pretest

E2 = Post test

X1 = Lecture Based Learning

X2 = Game Based Learning

Before carrying out data analysis, it is necessary to test the prerequisites for normality and homogeneity as well as independent sample, paired sample and n-gain tests.

The normality test is carried out to determine whether the data used is a normally distributed population or not (Creswell & Creswell, 2023). The normality test uses the Kolmogorov-Smirnov method with the help of the SPSS 25 application. The significance level of the normality test is 0.05. Decision making using the Kolmogorov-Smirnov test in SPSS is as follows:

- A significance value  $< 0.05$  means the data is not normally distributed.
- A significance value  $\geq 0.05$  means the data is normally distributed.

The homogeneity test is used to determine whether samples come from the same population or not (Field, 2024). The homogeneity test was carried out by carrying out Levene's test with a significance level of 5% and calculations using the SPSS 25 application.

After carrying out the prerequisite tests, analysis was carried out using the independent sample t-test, paired sample t-test and n-gain. The formula for calculating the n-gain score is:

$$\text{Normal Gain} = \frac{\text{Skor Post Test} - \text{Skor Pre Test}}{\text{Skor Ideal} - \text{Skor Pre Test}}$$

### 3. RESULT AND ANALYSIS (10 PT)

#### 3.1. RESULT

After carrying out a pretest and post-test in both classes to determine whether there was an influence on student learning outcomes using the game-based learning model. The pretest is carried out to determine students' initial knowledge before being given the learning model treatment, and the post-test is the students' final test after being given the learning model treatment. Pretest and post-test data are in the table below:

Table 2. Experimental Class Learning Results

	N	Nilai Minimum	Nilai Maksimum	Rata-Rata	Standar Deviasi
Pre-test Experimental Class	32	29,4	88,2	61,4	17,80
Post test Experimental Class	32	47,1	100	74,81	17,43
Valid N	32				

Table 3. Control Class Learning Results

	N	Nilai Minimum	Nilai Maksimum	Rata-Rata	Standar Deviasi
Pre-test Control Class	32	35,3	88,2	64,16	15,41
Post test Control Class	32	41,2	94,1	70,95	15,66
Valid N	32				

After knowing the pretest and post test data on student learning outcomes in the experimental and control classes, prerequisite analysis tests were then carried out, namely normality and homogeneity tests. The normality test results are in the following table:

Table 4. Experimental Class Normality Test Results

Keterangan	Sig	$\alpha$	Conclusion
Pretest Experimental Class	0,179	0,05	Normal
Post test Experimental Class	0,200	0,05	Normal

Table 5. Control Class Normality Test Results

Keterangan	Sig	$\alpha$	Conclusion
Pretest Control Class	0,178	0,05	Normal
Post test Control Class	0,200	0,05	Normal

Table 6. Homogeneity Test Results

Levene Statistic	Sig	$\alpha$	Conclusion
0,971	0,328	0,05	Homogen

Based on normality and homogeneity tests, the significance value for the experimental class in the pretest data was  $0.179 > 0.05$  and post-test  $0.200 > 0.05$ , so the data were normally distributed. Meanwhile, in the control class, the pretest significance value was  $0.178 > 0.05$ , and the posttest was  $0.200 > 0.05$ , so the data were normally distributed. Furthermore, the homogeneity test has a significant value of  $0.328 > 0.05$ , so that the data is declared homogeneous.

To determine the effect of game-based learning assisted by Wordwall on learning outcomes, an independent sample t-test and a paired sample t-test were carried out. The Independent Sample T-Test was used to see the difference in the mean score of the experimental group that was given game-based learning treatment assisted by Wordwall and the control group that was given lecture learning assisted by PowerPoint. The Paired Sample T-Test is used to determine whether there is a difference in the average of two paired samples, both before and after treatment. The hypothesis in this research is:

H0 = There is no influence on student learning outcomes who use the game-based learning model assisted by Wordwall.

H1 = There is an influence on student learning outcomes who use the game-based learning model assisted by Wordwall.

Decision-making uses a significance level of 0.05. If the sig. (2-tailed)  $< 0.05$  then H0 is rejected, conversely if the value is significant. (2-tailed)  $> 0.05$  then H0 is accepted. The following are the calculation results of the independent test and paired sample t-test in the following table:

Table 7. Independent Sample T Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	Df	Sig.(2-tailed)
Student learning outcomes	Equal variances assumed	0,971	0,328	0,931	62	0,036
	Equal variances not assumed			0,931	61,299	0,035

Table 8. Paired Sample T Test Results

		t	df	Sig. (2-tailed)
Pair 1	Pretest – Post test Experimental Class	-10,8208	31	0,000

Next, to determine the level of student learning outcomes in the experimental and control classes, the n- gain score was calculated. The results of the n-gain score calculation are in the following table:

Table 9. N-Gain Score Results

N-Gain (Mean)	Experimental Class	Control Class
	0.4212	0.1630

In the table above, it can be seen that the average N-Gain Score of the experimental group and the control group is different, with the experimental group's value being 0.4212 and the control group's value being 0.1630. The average N-Gain Score obtained in the two groups showed a difference of 0.2582, with the experimental group getting a higher score than the control group. The N-Gain Score criteria obtained by the experimental group were in the

medium category, while the control group was in the low category. So, the use of the game-based learning model assisted by Wordwall is more effective than the lecture learning model assisted by PowerPoint.

### 3.2. ANALYSIS

Based on the Independent Sample T-Test and Paired Sample T-test. The results obtained using the Independent Sample T-Test show that  $H_a$  is accepted and  $H_0$  is rejected based on the results of the Sig calculation. (2-tailed)  $0.036 < 0.05$ , so the conclusion is that there is a difference in the average learning outcomes between the experimental group that applied game-based learning assisted by Wordwall and the control group that applied PowerPoint-based lecture learning. Meanwhile, the results of the Paired Sample T-Test on the pretest and post-test learning outcomes of the experimental group obtained a Sig. (2-tailed) of 0.000, so that  $0.000 < 0.05$ . In this way, the conclusion is that there is a difference between the pretest and post-test learning outcomes in the experimental group, which explains that there is an influence on the application of game-based learning assisted by Wordwall on the informatics learning outcomes for class VII in SMP Negeri 3 Colomadu. Research conducted by (Annisa et al., 2025; Jatmika et al., 2025) proves that the application of Wordwall in classroom learning can effectively increase student activity in learning. In this research, the use of Wordwall as a learning medium can be used to maximize student knowledge. The results of this research are also supported by research conducted by (Alfares, 2025; Dwanda Putra et al., 2024; Wahyuni et al., 2023), which explains that the use of game-based learning can improve student learning outcomes. The average learning outcome value of the group that was given game-based learning treatment was higher than that of the group that was not given treatment.

Based on the results of the N-Gain Score test after it was carried out, it resulted in the conclusion that there was an increase in student learning outcomes after being given treatment in the experimental and control groups. The results of the N Gain test calculation for the experimental group produced an average of 0.4212, which was included in the medium criteria, while the control group produced an average of 0.1630, which was included in the low criteria. From the average value produced by the two groups, there is a difference of 0.2582, with the experimental group getting a greater value than the control group. N-Gain results are said to be effective if they fall into the medium criteria, namely  $0.3 \leq g \leq 0.7$  or above (Raharjo, Suryati, & Khery, 2017). In this way, the N-Gain criteria obtained in the experimental group were effective, while for the control group with low N-Gain criteria, they were less effective. Therefore, the conclusion is that learning with game-based learning assisted by Wordwall is more effective for learning. These results are also supported by research from (Gundersen & Lampropoulos, 2025; Rahman et al., 2025) In research that has been carried out, it has shown that learning to use game-based learning assisted by Wordwall is quite effective for improving student learning outcomes. Based on this, it can be concluded that the level of influence in implementing the Wordwall-assisted game-based learning model is higher than applying the PowerPoint-based lecture learning during the learning process.

The superior learning outcomes observed in the experimental group can be interpreted through several converging theoretical frameworks. From the perspective of Self-Determination Theory (Deci & Ryan, 1985), Game-based learning environments such as Wordwall are well-positioned to satisfy three fundamental psychological needs: autonomy, competence, and relatedness. Wordwall's interactive format allows students to engage with content at their own pace and receive immediate corrective feedback, thus supporting their sense of competence and autonomous engagement — conditions that SDT identifies as conducive to intrinsic motivation and deeper information processing. Complementarily, Csikszentmihalyi, (1990) Flow Theory offers a further explanatory lens: Wordwall's dynamic scoring and time-limited challenge structure is designed to maintain a balance between task difficulty and student skill level, thereby inducing a state of "flow" — characterised by deep concentration, heightened engagement, and reduced awareness of time — that is associated with enhanced learning efficiency. In contrast, the conventional PowerPoint-assisted lecture method employed in the control group offers limited interactivity and feedback, predominantly addressing lower-order cognitive processes (recall and recognition) without creating the motivational conditions described above.

### 4. CONCLUSION

This study sought to examine whether game-based learning assisted by Wordwall produces a measurable improvement in informatics learning outcomes among Grade 7 students at SMP Negeri 3 Colomadu, compared to conventional PowerPoint-assisted lecture instruction. The findings confirm this hypothesis. The independent sample t-test yielded a significant value of 0.036 ( $p < 0.05$ ), indicating a statistically significant difference in post-test learning outcomes between the experimental and control groups. Furthermore, the paired sample t-test demonstrated a significant pre-to-post improvement within the experimental group ( $p = 0.000 < 0.05$ ). The N-Gain Score analysis

reinforced this conclusion: the experimental group achieved a mean N-Gain of 0.4212 (medium category), while the control group recorded 0.1630 (low category), representing a difference of 0.2582 in favour of the Wordwall-assisted GBL approach.

These results contribute to the growing body of empirical evidence on technology-enhanced learning by demonstrating that a freely accessible, game-based digital platform such as Wordwall can produce a significant positive effect on student achievement in informatics education at the junior secondary level. Prior studies on game-based learning, including those by (Ramadhani et al., 2025), have reported similar positive trends across various subjects. The present study extends this literature by providing controlled quasi-experimental evidence specifically within an Indonesian informatics curriculum context, a setting that has remained underrepresented in the international GBL literature. The medium-category N-Gain score obtained by the experimental group suggests that Wordwall-assisted GBL is not merely engaging but can generate meaningful learning progression, reinforcing theoretical premise that interactive and game-like activities activate deeper cognitive engagement compared to passive instructional formats.

From a practical standpoint, these findings carry direct implications for informatics teachers at the junior secondary level. Educators are encouraged to integrate Wordwall as a supplementary review and assessment tool within their instructional sequences, particularly for reinforcing conceptual understanding and procedural knowledge at the end of learning units. The platform's accessibility — requiring only an internet-connected device and no prior programming knowledge — makes it a realistic and scalable option for schools with varying levels of digital infrastructure. School administrators and curriculum developers may likewise consider incorporating GBL platforms such as Wordwall into official teaching guidelines for informatics subjects, recognizing their demonstrated potential to improve learning outcomes without requiring substantial additional resources. Nevertheless, the present findings are based on a single school setting with a limited sample size; future research should therefore seek to replicate and extend these results across multiple schools, geographic regions, and informatics topic areas in order to establish stronger generalizability and identify the conditions under which Wordwall-assisted GBL is most effective.

## 5. LIMITATION AND FUTURE RESEARCH

Several limitations of this study should be acknowledged when interpreting its findings. First, and most importantly, the study was conducted in a single school (SMP Negeri 3 Colomadu, Karanganyar Regency) with a total sample of 64 students drawn from two intact classes. This limits the generalizability of the findings beyond the immediate research context; the results may not be representative of students in schools with different digital infrastructure, teaching cultures, or socioeconomic conditions across other regions of Indonesia or internationally. Second, the use of cluster random sampling — in which whole classes rather than individual students were randomly assigned to conditions — introduces the risk of selection bias. Pre-existing differences between Class VII A and Class VII B in terms of prior academic achievement, classroom dynamics, or teacher familiarity with the subject matter cannot be entirely ruled out as contributing factors to the observed outcome differences, despite the preliminary equivalence indicated by the homogeneity test. Third, the duration and number of instructional sessions constituting the Wordwall-assisted GBL intervention were not explicitly specified in this study. Without a clear account of the total contact hours and the scope of informatics content covered, it is difficult to assess the dose-response relationship between the intervention and learning gains, or to enable precise replication by other researchers. Fourth, data collection relied exclusively on a cognitive achievement test (pretest and post-test), and no measures of affective or motivational outcomes — such as student engagement, learning satisfaction, or digital self-efficacy — were included. Consequently, the mechanism through which Wordwall-assisted GBL produced its effect on learning outcomes remains unclear. Fifth, the study design did not include a delayed post-test, meaning that no conclusions can be drawn regarding the long-term retention of learning. It is possible that the observed gains partly reflect a short-term novelty effect associated with the use of a new digital platform, rather than durable learning. Future research addressing these limitations would substantially strengthen the evidence base for GBL in informatics education.

While this study provides initial quasi-experimental evidence for the effectiveness of Wordwall-assisted game-based learning in a single junior secondary school context, several directions warrant further investigation. First, future studies should conduct multi-site replications across schools with varying socioeconomic profiles, geographic locations (urban, peri-urban, and rural), and levels of digital infrastructure in Indonesia, to establish the generalisability of these findings and to identify the contextual conditions under which GBL is most and least effective. Second, subsequent research should examine long-term retention effects by incorporating delayed post-tests administered two to four weeks after the intervention, thereby distinguishing genuine learning consolidation from short-term performance gains attributable to novelty effects. Third, future investigations should measure motivational and

affective mediating variables — including student engagement, intrinsic motivation, and digital self-efficacy — using validated instruments alongside achievement tests, to explain the mechanism through which game-based learning produces its effects on learning outcomes. Fourth, comparative studies contrasting Wordwall against other popular GBL platforms (e.g., Kahoot!, Quizlet Live, or Gimkit) within the same subject and grade level would help practitioners make evidence-based platform selection decisions. Finally, a mixed methods design that combines quantitative learning outcome measures with qualitative data from student and teacher perspectives would enrich understanding of how GBL is experienced and implemented in practice, informing more nuanced pedagogical recommendations for informatics education in the Indonesian secondary school context.

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