

The Application of Wordwall Digital Game-Based Learning to Enhance Digital Etiquette Literacy, Learning Motivation, and Student Engagement

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A B S T R A C T

This study examines the application of the Digital Game-Based Learning (DGBL) approach, utilizing the Wordwall platform, to enhance students' digital etiquette literacy, learning motivation, and engagement. Employing a quantitative method with a quasi-experimental one-group pretest-posttest design, the research involved 50 students from class XI.13 at SMAN 12 Tangerang Regency, selected using a saturated sampling technique. Data were collected through questionnaires and assessment items developed based on indicators of digital literacy, motivation, and student engagement. The results were analyzed using a paired-sample t-test to determine the significance of the changes before and after the intervention. Findings indicate that the DGBL approach using Wordwall effectively increased students' learning motivation and engagement. However, digital etiquette literacy did not significantly improve, suggesting the need for more immersive, simulation-based game designs to foster ethical digital behavior.



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INTRODUCTION

The term "digital generation" refers to individuals born and raised in a digital age that relies heavily on the internet for information and interaction (Zheng et al., 2024). In Indonesia, the number of internet users continues to grow along with the penetration of digital technology. According to the Indonesian Internet Service Providers Association (APJII), as of 2024, there will be 221.563.479 internet users in Indonesia out of a total population of 278.696.200 people in 2023. Internet penetration data is at 79.5%, indicating an increase of 1.4% from the previous period (APJII, 2024). This data highlights the significant role of the internet in shaping the behavior and communication patterns of the digital generation in Indonesia.

However, as internet users increase, challenges related to digital literacy and digital ethics also arise. Digital literacy encompasses not only the ability to access and operate technology but also the capacity to search, evaluate, and use information critically and responsibly (Liu et al., 2020; Farias-Gaytan et al., 2022). In the educational environment, students often use smartphones, tablets, and computers to access academic materials and communicate (Kurniasanti et al., 2019; Lareki et al., 2016). Digital literacy skills continue to evolve in line

with technological advances that are changing the way humans interact (Murdy & Putri, 2020). However, without adequate digital literacy and ethical awareness, students become vulnerable to cyberbullying, digital fraud, privacy violations, and internet addiction (Zheng et al., 2024). Therefore, in this era of information technology, students not only use technology but also interact through digital platforms that require an understanding of the right norms and behaviors known as digital etiquette.

Digital etiquette is one of the pillars of digital citizenship that describes electronic standards of behavior or procedures that reflect responsibility and positive attitudes when using digital devices (Ribble, 2021). This means that we need to educate the younger generation as soon as possible to use the internet in a safe, responsible, and ethical way (Wang et al., 2024). Based on observations, it is noted that there is a low awareness of appropriate digital behavior, including the misuse of the school internet for non-academic purposes. It requires a new foundation to build confidence in technology (Petousi & Sifaki, 2020). Therefore, today's educators must be able to involve technology in every learning activity. To motivate students to make them more involved in learning activities, learning will become more interesting.

Along with the development of technology, education must also be able to integrate technology into the learning process. Research has shown that the use of digital games in education can be more effective than conventional lecture-based strategies (Tay et al., 2022; Welbers et al., 2019). Digital Game-Based Learning is a teaching method that integrates digital game elements with learning design, aiming to present more active and entertaining knowledge (Tay et al., 2022). One of the reasons students like digital games is that they allow them to feel a different role, which can support confidence and reduce stress through increased dopamine (Fajarseli, 2023). However, if the use of digital games is not supervised, negative impacts such as addiction, loss of connection with real life, and waste can arise (Ibad, 2022). However, if used wisely, digital games have positive potential, such as improving concentration, brain performance, and helping to reduce stress and increase socialization (Ibad, 2022). Thus, Digital Game-Based Learning can make the learning process more interesting, but it can also increase students' motivation and concentration to learn as long as its use is supervised wisely to avoid negative risks.

Student motivation is also a crucial factor in the successful implementation of Digital Game-Based Learning. Through motivation, each individual is encouraged to engage in learning activities. In the context of education, learning motivation is a crucial element that moves students to be involved in the learning process (Fianora, 2019 & Saepuloh, 2019). The use of digital games as a learning tool has a positive influence on students' learning motivation (Sukri, 2019; Akour et al., 2020; Chebotareva et al., 2020; Dimitra et al., 2020; Lioni & Friyatmi, 2024). Digital games can make learning more efficient and effective. Based on observations indicating that students' motivation to learn remains low, many students exhibit minimal participation, lack enthusiasm, and tend to rely solely on teachers' explanations without taking the initiative to explore the material independently. Educators need to develop digital games that are tailored to the specific needs and conditions of students in an integrated, systematic, and effective manner, so that they will trigger student motivation to engage in the learning process. A study conducted by Safitri et al. (2022) suggests that the use of digital game media can encourage an increase in learning motivation.

Digital Game-Based Learning not only increases student motivation but also encourages deeper engagement with the subject matter. Zheng et al. (2024) state that Digital Game-Based Learning creates an interactive and fun learning environment, contributing to increased cognitive, emotional, and behavioral engagement of students. When students engage in game-based learning, they tend to be more active, collaborative, and responsive in classroom activities. This is in line with the findings of Nadeem et al. (2023), revealing that the use of digital games is able to increase student involvement in the learning process, especially because digital games present an interactive and fun learning experience. Based on the results of observations, it is stated that many students still show low involvement in classroom learning, especially in economics subjects. This can be seen from students' passive behavior, such as a lack of questions and a lack of involvement in class discussions.

In the application of Digital Game-Based Learning, the Wordwall platform is an effective tool for creating interactive games that are relevant to learning materials. Wordwall enables teachers to create games that students can easily access on various digital devices (Safitri et al., 2022). For example, in the subject of Economics, teachers can create interactive games that contain questions related to per capita income. With this game, students not only learn theory but also apply economic concepts in real-life game situations. This finding aligns with the

results of Dele-Ajayi et al. (2019), who revealed that the application of Digital Game-Based Learning encourages student motivation and involvement in learning activities.

Based on the literature review and previous research, there is a research gap related to the application of digital game-based learning (DGBL) in Economics subjects at the high school level, because most of the previous research focused more on Mathematics, Science, or Language, so that the development of interactive digital game media for Economics subjects has not been widely researched. The novelty of this study is to simultaneously test digital etiquette literacy, learning motivation, and student involvement in a digital game-based learning model using the Wordwall platform, which has generally only been used as a quiz or exercise medium. With the increasing use of digital technology among students, this research is expected to make a significant contribution to the development of education quality through learning strategies that are relevant to the characteristics of the digital generation, especially in the context of Economics learning, so as to make a theoretical and practical contribution to technology-based learning innovations in Indonesia.

RESEARCH METHODS

This research is part of a quantitative study. The method used in this study is a quasi-experimental quantitative method. This approach has a control group, but it cannot completely control the external variables that affect the experiment (Sugiono, 2019). The research population consists of one class, namely Class XI 13, with a total of 50 students, whom the school selected after applying for a research permit. The sample used was *saturated sampling*. *Saturated sampling* is a sample determination technique in which all members of the population are used as samples. The research design employed was a group pretest-posttest design, where one group received an initial test (pretest) prior to treatment and a final test (posttest) afterwards.

This research employed instruments, including questionnaires and questions adjusted by indicators, developed to enhance digital etiquette literacy, learning motivation, and student involvement. The indicators used in this study are as follows: (1) Digital etiquette literacy obtained from (Jones & Mitchell, 2016; Pector & Hsiung, 2011; Iordache et al., 2017), which refers to awareness of etiquette, polite words, respectful behavior, active participation, digital communication and information, digital content creation, technical and operational skills, and digital strategies; (2) Learning motivation is obtained from (Wang and Chen, 2010; Richardson, 2017; Astuti et al., 2020), i.e. refers to the impulse and need in the learning process, a high level of curiosity, individual identity and well-being, reward-motivated learning, desire and passion for success, aspirations and goals in the future, appreciation for the learning process, engaging learning activities, and a supportive learning environment; (3) Student learning engagement was obtained from (Wickramasinghe et al., 2018; Ramadhani et al., 2021; Fikrie & Ariani, 2019; Elvira & Zafri, 2021), which refers to cognitive involvement (willingness to learn complex ideas and master difficult skills), behavioral involvement (active participation in learning activities and tasks), emotional involvement (good and bad responses to teacher teaching and interaction with classmates), discussing, presenting, expressing opinions, taking individual tests, asking questions, answering, taking notes of teachers' explanations, selecting assignments thoroughly and conclude the subject matter.

For the evaluation of questions using critical thinking indicators, it was obtained from (Susanto, 2016; Rain, 2017; Pertiwi, 2018), which includes analysis, introduction, problem-solving, drawing conclusions, assessing, identifying, and evaluating applicable assumptions, preparing explanations with significant considerations, as well as preparing information, interpreting, and drawing inferences. The questionnaires and questions asked of students were compiled into a total of 31 statements, which refer to the above indicators. These include 10 statements about digital etiquette literacy, 9 statements about learning motivation, 12 statements about student learning engagement, and 9 questions about critical thinking. The instruments tested in this study are validity and reliability.

The validity test assesses whether the instrument accurately measures what it wants to measure. In this study, the Pearson correlation method was used to evaluate validity. This involves calculating the correlation coefficient for each item on the questionnaire. The resulting correlation coefficient (r) must then be tested for significance using the t-test or by comparing it with the r-table. If the significance value for each statement is found to be less than the alpha level of 0.05, it can be concluded that the statement is valid. The results of the validity test for the variables of digital etiquette literacy, learning motivation, and student engagement showed that all questionnaire items were valid, because all calculated r-values exceeded the critical r-table value of 0.279 and were positive.

The reliability test assesses the consistency and reliability of the measurement instrument. Based on SPSS analysis, Cronbach's alpha value for each statement exceeds 0.6, which indicates that each statement can be considered reliable. The results of the reliability test for digital etiquette literacy, learning motivation, and student engagement showed that all variables had an alpha coefficient of 0.893. This confirms that all concepts measured by the questionnaire are reliable, indicating that the items in each variable are suitable for use as an assessment tool.

RESULTS AND DISCUSSION

Result

The data obtained will be processed using normality tests, homogeneity tests, and paired sample t-tests. SPSS software version 25 will be used for this. To determine whether all research variables are normally distributed, a normality test is employed. Kolmogorov-Smirnov used the decision criteria to test normal conditions. The data is considered to be distributed regularly if the significance value is greater than 0.05. The following are the findings of the normality test:

Table 1. Normality Test Results Kolmogorov-Smirnov

	Statistic	df	Sig.
Pre-test	.078	50	.200*
Post-test	.075	50	.200*

Source: Processed data using SPSS 25 (author’s analysis)

In Table 1, the findings of the Kolmogorov-Smirnov normality test, with a significance value of 0.200 > 0.05, indicate that the pretest and posttest data are normally distributed. The variables were considered regularly distributed because the Ho test requirements were rejected, and Ha was approved. Two or more sample datasets must be from populations that have the same variant, as determined by the homogeneity test. This test is a key requirement before conducting advanced statistical analysis. With this test, it can be confirmed that the data groups do have the same population characteristics. The test results showed that the significance value for homogeneity was 0.000 < 0.05, indicating that the pretest and posttest variables after treatment are not homogeneous, with a Levene's Statistic of 105.489. Here are the results of the homogeneity test:

Table 2. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
105.489	13	17	.000

Source: Processed data using SPSS 25 (author’s analysis)

The t-test is generally used to compare the means between groups, but it assumes that the data are normally distributed and have homogeneous variance. (Delacre et al., 2017). If the assumptions of normality and homogeneity are not met, particularly when variances are heterogeneous, the t-test can still provide valid conclusions. (N. Khan et al., 2016; Zimmerman & Zumbo, 1992). The Welch t-test is proposed as a more robust alternative, particularly when the group sizes or variances are not comparable. (Delacre et al., 2017; L. Zheng et al., 2013). In this study, the researcher continues to conduct a different test to analyze the research data. A paired sample t-test was then conducted to determine whether there was a significant difference between the pre-test scores and the post-test scores for the variables of digital etiquette literacy, learning motivation, and student engagement after the implementation of the Wordwall digital game-based learning model.

Then, if the score (2-tailed) on the learning motivation variable is 0.001 < 0.05, Ha is accepted and H0 is rejected. This shows that the learning motivation scores of students in the pre-test and post-test on the use of the Wordwall Digital Game-Based Learning paradigm have changed significantly. The test findings indicate that the use of the Wordwall Digital Game-Based Learning paradigm has been successful in increasing students’ learning motivation.

Table 3. Results of the Paired Sample T-Test: Digital Etiquette Literacy, Learning Motivation, and Student Engagement

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Pretest - Posttest	.32000	4,76997	.67458	-1,03561	1,67561	.474	49	.637
Pair 1	Pretest - Posttest	2,48000	4,84553	0,68526	1,10291	3,85709	3,619	49	.001
Pair 1	Pretest - Posttest	3,56000	5,45916	0,77204	2,00852	5,11148	4,611	49	0,000

Source: Processed data using SPSS 25 (author's analysis)

Furthermore, in the learning motivation variable, the significance value is (2-tailed) is $0.001 < 0.05$, then H_0 is rejected. This indicates a significant difference in the learning motivation scores between pre-test and post-test students who applied the Wordwall Digital Game-Based Learning model. The results of this test indicate that the application of the Wordwall Digital Game-Based Learning model has been successful in increasing student learning motivation. Similarly, in the variable of student involvement, the value of Sig. (2-tailed) is $0.000 < 0.05$, then H_0 is rejected. This indicates a significant difference in student engagement value before and after the use of the Wordwall game-based digital learning model.

Table 4. Critical Thinking Learning Outcomes Using Descriptions Based on Minimum Mastery Criteria Scores

No	Interval	Frequency	Percentage (%)	Learning Outcome Level
1.	0 – 45	10	26.32%	Very Low
2.	46 – 55	10	26.32%	Low
3.	56 – 69	8	21.04%	Keep
4.	70 – 84	5	13.16%	Tall
5.	85 – 100	5	13.16%	Very High
	Sum		100	

Source: Processed data (author's analysis)

The results of critical thinking learning using descriptions based on KKM scores show that the majority of students, 73.68%, have not reached KKM 70 scores, consisting of very low, low, and medium levels. Only 26.32% of students managed to achieve KKM, with details of 13.16% being at a high level and 13.16% being at a very high level. These findings state that the majority of students experience difficulties in critical thinking, so it is necessary to carry out more effective learning interventions, such as the application of innovative learning models or more interactive teaching strategies, to improve academic achievement and help students achieve KKM.

Discussion

After ensuring that the data is distributed normally, the results show that the application of the learning method through the Wordwall Digital Game-Based Learning approach has an effect on student learning motivation and engagement, but digital etiquette literacy has not been significant for economic learning in grade XI.13. Before this step is implemented, students tend to have difficulty understanding the learning material. However, after the implementation of the Wordwall Digital Game-Based Learning method, there was a significant increase in learning motivation and student engagement. Students are more focused, actively participate, and show enthusiasm in the economic learning process.

Application of Wordwall Digital Game-Based Learning Method to Digital Etiquette Literacy

This study shows that the application of Wordwall Digital Game-Based Learning has not had a significant influence on students' digital etiquette literacy. The analysis of the normality test using Kolmogorov-Smirnov

showed that the pre-test and post-test data were normally distributed normal Sig. Values of $0.200 > 0.05$. In addition, the results of the paired sample t-test produced a Sig. (2-tailed) value of $0.637 > 0.05$. This means that no significant difference was found between the pretest and posttest results. These findings are in line with the opinion of Zheng et al., (2024) The success of DGBL is highly dependent on game design and its relevance to students' real lives. If the game elements are less challenging or irrelevant, the impact on digital etiquette literacy will be limited.

In this case, the design of Wordwall still needs to be improved, for example by adding a real case simulation feature or reflection elements that allow students to associate digital etiquette literacy with daily life conditions. In the school where the research was conducted, the use of Wordwall by teachers and students was still limited to simple quiz and exercise features without the development of more contextual and interactive content. This is in line with the idea of constructivist learning which affirms that learning will be more effective if students learn in meaningful contexts with adequate support (Boyle et al., 2011). Although the results of the statistical test do not show a significant difference, DGBL still has great potential to improve digital etiquette literacy if game design is improved. Therefore, the development of more relevant and interactive Wordwall, for example, through real-world scenarios and direct feedback, can be an effective strategy to support students' understanding of digital etiquette literacy.

Application of Wordwall Digital Game-Based Learning Method to Learning Motivation

Based on the findings of the research, the use of the Wordwall Digital Game-Based Learning model greatly increases student learning motivation. The Kolmogorov-Smirnov normality test study showed that the pre-test and post-test data had a Sig. Value of $0.200 > 0.05$ with normal distribution. In addition, the findings of the paired sample t-test produced a Sig (2-tailed) value of $0.001 < 0.05$, which showed a significant difference between learning motivation before and after the implementation of the learning model. In the school where the research was conducted, students' previous learning motivation tended to be low, mainly because the learning methods used were still conventional and less attractive to today's digital generation. With the implementation of Wordwall which presents interactive elements such as quizzes, challenges, and real-time feedback, students became more motivated and enthusiastic in following the learning process. This is in accordance with field observations that students were more active in participating and showed increased enthusiasm for learning after using this media.

In line with the findings of the research of Salsabila et al., (2023) This revealed that the use of Wordwall significantly increases student learning motivation. Furthermore, Nadeem et al., (2023) Additionally, it was found that the use of game elements, such as leaderboards and challenges, increased student engagement and motivation. The research of Safitri et al., (2022) Additionally, it has been confirmed that Wordwall has a positive impact on student motivation, particularly through its interactive features, such as quizzes and group challenges. In-game features such as achievements, challenges, and real-time feedback provide additional motivation for students to stay engaged and focused throughout the learning process.

This study was also strengthened by Fitriati et al., (2021) Who stated that, on average, 88.06% of students showed high learning motivation after using digital games? From an educational perspective, the integration of digital games not only increases motivation but also supports students' cognitive engagement. Bustamante et al., (2018) Stated that a game-based learning approach can develop problem-solving skills while improving learning efficiency. With the right motivation, students are more encouraged to actively participate in the learning process, achieve optimal achievements, and face learning challenges with more confidence. (Karundeng et al., 2024; Saepuloh, 2019). Therefore, Wordwall serves not only as a means of learning but also as an innovative medium to support student-centered learning.

Application of Wordwall Digital Game-Based Learning Method to Student Engagement

The results of the analysis show that the application of the Wordwall Digital Game-Based Learning (DGBL) model has a significant influence on student involvement in learning. The analysis of the normality test using the Kolmogorov-Smirnov test showed that the pretest and posttest data were distributed normally, with Sig values of 0.200 , which is greater than 0.05 . In addition, the results of the paired sample t-test produced a Sig. (2-tailed) A value of $0.000 < 0.05$ was observed, indicating a significant difference in student involvement before and after the implementation of this model. The findings suggest that an environment-based approach can foster a more engaging and enjoyable learning atmosphere. The research reinforces this study.

In the school where the research was conducted, student engagement during the learning process tends to be low, especially when the methods used are conventional and less interactive. With the implementation of Wordwall, students become more active and enthusiastic because the learning atmosphere is more enjoyable and relevant to their daily lives. This study was strengthened by Zheng et al. (2024) it is revealed that students who learn through DGBL show higher engagement, especially in aspects of behavioral and emotional engagement. This game-based approach allows students to interact in fun and relevant learning situations, thereby increasing their motivation. This is supported by Breien & Wasson (2021), who found that the narrative in the DGBL increases student engagement and motivation, especially through game elements such as interactive stories and context-based challenges.

In line with the findings of the research of Huizenga et al., (2009) observed that students who learn to use games show a higher level of engagement compared to traditional methods. The research of Hamari et al., (2019) also confirmed that the use of digital games in education can increase student engagement by up to 60%, which ultimately has a positive impact on their motivation. This shows that DGBL is effective in encouraging the active participation of students by using a relevant and fun approach. Digital Game-Based Learning also provides a more immersive learning experience by connecting academic concepts to relevant scenarios. The research of Wang et al., (2024) supports that DGBL, in addition to increasing engagement, also helps students understand content through simulations and problem-based activities. In other words, this approach reinforces constructivist learning, where students actively develop understanding through hands-on experience. Thus, the implementation of Wordwall in this study aligns with the global trend in innovative and participatory technology-based education.

Application of Wordwall Digital Game-Based Learning Method to Critical Thinking

Based on the results of the analysis, based on the actual conditions in the school where the research was conducted, the low achievement of KKM in students' critical thinking skills is very reflective of the challenges faced in current learning. Most students still have difficulty in analyzing, evaluating, and interpreting information in depth, which is the core of critical thinking skills. This can be seen from 73.68% of students are included in low, very low, and medium levels, which shows that they have not obtained the minimum completeness criterion (KKM), which is 70. The KKM was only achieved by 26.32% of students, which means that students' critical thinking skills are still low. This situation reflects students' difficulties in honing the ability to analyze, evaluate, and interpret, which is a major component of critical thinking. Critical thinking skills are an important element for students because they are related to identifying, analyzing, and solving problems innovatively and rationally to achieve accurate decisions. (Saepuloh et al., 2021).

In line with the findings of Ennis' (2011) Research critical thinking skills is a skill that must be trained through a systematic and interesting approach. Digital Game-Based Learning (DGBL), which relies on platforms such as Wordwall, is one of the learning approaches that can be applied. Research by Prensky (2001) and Gee (2007) Shows that game-based learning creates interactive and fun learning experiences, increases student engagement, and stimulates their ability to think critically through challenges that are relevant to the learning material.

The results of the research by Radityastuti et al., (2023) Also supports the effectiveness of DGBL, which shows that this method has a more significant impact compared to the non-digital game-based learning (NDGBL) learning model, and students in the DGBL problem-based learning model (PBL) show an improvement in their critical thinking skills in the medium category. Students in other models showed different results. Thus, the application of Wordwall Digital Game-Based Learning can be an innovative and effective solution to help students achieve KKM while developing better critical thinking skills. With this innovation, overall learning outcomes are improved because students are not only motivated to learn but are also asked to actively participate in learning activities.

CONCLUSION

This study aims to test the application of Wordwall Digital Game-Based Learning (DGBL) to improve digital etiquette literacy, learning motivation, and student engagement in economics. The results of the study show that this model has not had a significant impact on students' digital etiquette literacy, which is likely due to the game design that is less relevant to real life. However, Wordwall DGBL has proven to be effective in increasing student motivation and engagement. These findings are supported by interactive features such as

leaderboards, challenges, and real-time feedback that create a fun learning atmosphere. In addition, the low critical thinking skills of students indicate the need for additional strategies to develop students' analytical and evaluation skills.

However, this finding has limitations. The game design used is not fully relevant to the needs of students, so the results are less than optimal in digital etiquette literacy. The research sample, which is limited to one class (experimental class), does not use two classes (control class), thus limiting the results in depth. In addition, the relatively short duration of the study likely had an effect on the limitations of the results, especially in improving critical thinking skills.

To increase the effectiveness of the Wordwall DGBL model, teachers are advised to integrate more relevant elements, such as real-life case simulations and reflections, to make learning more contextual and meaningful for students. Teachers can also utilize a problem-based approach to train students to think critically. Future research is encouraged to use a wider sample and experimental design with a control group to compare the results in more depth. In addition, the research can explore additional variables, such as collaboration skills or creativity, as well as examine the impact of Wordwall DGBL on various subjects. The results of this study show the implication that DGBL is not only effective in increasing student motivation and engagement but also has the potential to become an innovative medium to support technology-based learning.

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