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# Differences in Students' Creative Thinking Skills Between Those Taught Using Wordwall and Educaplay in Science Subjects

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**Abstract:** This study aimed to examine the differences in creative thinking skills among seventh-grade students taught using Wordwall and Educaplay in science learning at SMP Negeri 16 Mandai. A quasi-experimental method with a pretest-posttest non-equivalent group design was used. The sample consisted of two experimental classes: Wordwall (n = 32) and Educaplay (n = 31). Data were obtained through a creative thinking skills test and analyzed using ANCOVA. The results showed no significant difference in students' creative thinking skills between the Wordwall and Educaplay groups (p = 0.788). This indicates that both quiz-based media had a comparable effect on students' creative thinking performance. Although descriptive data showed improvements in posttest scores in both groups, the statistical analysis confirmed that the difference between the two media was not significant. It can be concluded that Wordwall and Educaplay are equally effective in supporting the development of students' creative thinking skills in science learning, though neither showed superiority over the other.

**Keywords:** Creative thinking skills; Educaplay; Science; Wordwall

## Introduction

Creative thinking is a vital 21st-century competency that enables students to analyze information, synthesize ideas, and generate innovative solutions to real-world problems. In science education, this skill is especially crucial because students are often required to reason through complex systems and phenomena (Mainemelis et al., 2023). emphasized that the ability to think creatively underpins a student's capacity to navigate ambiguity and complexity in learning contexts.

In the era of globalization, individuals must master a variety of competencies to remain competitive. Sawyer (2022) stated that creative thinking equips individuals with the ability to analyze opportunities and challenges objectively. Similarly, Zaremohzzabieh et al. (2025) emphasized that adaptability and creative responsiveness are essential for success in unpredictable and dynamic environments. As a result, educational institutions must prepare graduates who are not only knowledgeable but also capable of critical and creative thought (Fauzi et al., 2020).

Despite its importance, creative thinking skills among Indonesian students remain low. According to the PISA 2022 results, Indonesia ranked 74th out of 81 countries in creative thinking, with an average score of 336, which is far below the OECD average of 478. This indicates a significant gap in students' ability to generate original ideas and solve problems creatively.

One contributing factor is the continued dominance of conventional, teacher-centered methods in science

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classrooms. Kurniawati (2023) found that 72% of science instruction in Indonesia still relies on minimally interactive approaches, which are not effective in developing students' creative abilities.

This situation is consistent with findings by Hikmah et al. (2023), whose meta-analysis showed that blended learning approaches significantly improved students' creative thinking in science subjects such as physics, biology, and chemistry. Their study highlights the importance of integrating digital and interactive learning platforms, including game-based tools, to support the development of creative thinking more effectively than traditional methods.

In addition to blended learning, digital media such as e-modules and educational games have shown promise in supporting 21st-century skills development. Fitri & Asrizal (2023) demonstrated that a physics e-module integrated with PBL and ethnoscience was both valid and practical for enhancing students' creative and critical thinking abilities.

More over, Hwang & Chen (2023) reported that interactive media could increase creative thinking by up to 40 percent compared to conventional instruction. Supporting this, classroom-based implementations of tools like the Wordwall Gameshow Quiz have been found to enhance student engagement, confidence, and participation. These factors are closely related to creative development (Rahma & Suratno, 2024).

Creative thinking includes the ability to produce original ideas, form new associations, and view problems from various perspectives (Widia et al., 2020). According to Ritter & Mostert (2017), it involves both divergent thinking, where multiple ideas are generated, and convergent thinking, where ideas are integrated into a solution. Beaty et al. (2022) explained that these processes are supported by activity in the default mode network (DMN) of the brain, which is involved in imagination and self-generated thought. Dumas et al. (2020) noted that creative individuals also exhibit cognitive resilience, enabling them to function effectively in ambiguous situations. Kapoor & Kaufman (2023) highlighted the role of metacognitive skills in directing and reflecting on one's own thought processes.

Game-based learning environments are recognized for their potential to foster creativity. Hamari & Nousiainen (2022) found that features such as scaffolded challenges and instant feedback help stimulate divergent thinking. Plass et al. (2023) demonstrated that games with open-ended elements encourage exploration and originality. Qian et al. (2023) argued that virtual environments allow students to test ideas without fear of failure, promoting creative risk-taking. According to Zaremohzzabieh et al. (2025), achievements in games can enhance students' confidence in their creative abilities. Runco & Jaeger (2022) further supported this by stating that game immersion enhances imaginative capacity and mental flexibility.

Wordwall is a digital platform offering various game-based templates that encourage active learning. Deterding et al. (2011) showed that such game formats can foster student motivation and creativity. Sailer & Homner (2020) emphasized that gamification elements like point systems and levels enhance engagement and stimulate innovation. Kazimoglu et al. (2012) found that games with step-by-step problem-solving processes, such as those in Wordwall, support the development of flexible thinking. Ke (2019) also noted that narrative-based digital games improve students' ability to generate original ideas. Wordwall's features, such as crosswords, matching tasks, and real-time feedback, allow students to explore alternative answers through trial and error.

Widyasari et al. (2024) found that the use of Wordwall media had a positive effect on students' understanding of science concepts, suggesting its potential to support creative thinking through interactive learning. Similarly, Ariyani et al. (2025) reported that the use of Wordwall media increased students' motivation and engagement, which led to more active participation and enhanced problem-solving skills. In addition, the development of interactive edugame learning evaluation assisted by Wordwall was found to be very feasible and effective in improving IPAS learning outcomes Prameswari (2024).

Similarly, Educaplay offers interactive tools designed to support creativity. Herrero et al. (2014) observed that features like interactive maps and simulations help students link abstract ideas and build problem-solving strategies. Romero et al. (2015) found that scenario-based quizzes in Educaplay enhance students' analytical and creative thinking. Parra-González et al. (2021) reported that using Educaplay significantly improves students' intrinsic motivation to think creatively, particularly in originality and elaboration. López-Belmonte et al. (2020) confirmed that Educaplay supports learning by combining game-based instruction with real-time student interaction. This is further supported by classroom research showing that Educaplay can enhance cognitive, affective, and psychomotor learning outcomes among elementary students, making it a promising tool for holistic skill development (Sari et al., 2025).

Previous studies have investigated Wordwall and Educaplay independently. Admiraal et al. (2020) examined Wordwall's effect on flexible thinking, while Hadi et al. (2023) evaluated its use in Indonesian science classes. Uzunboylu & Karagozlu (2015) investigated Educaplay's interface and engagement impact. However, to date, no study has directly compared the effectiveness of Wordwall and Educaplay in the context

of science learning, particularly in developing creative thinking skills. Therefore, this study aims to compare students' creative thinking skills between classes taught using Wordwall and those taught using Educaplay, specifically on the topic of ecology and biodiversity of Indonesia.

## Method

This research was a quasi-experimental study conducted from April to May 2025. The independent variable in this study was the use of Wordwall and Educaplay as digital learning media, while the dependent variable was students' creative thinking skills. The research design followed a non-equivalent pretest-posttest group structure, which is commonly used when random assignment of individuals is not possible.

The population consisted of all seventh-grade students at SMPN 16 Mandai, comprising nine classes that were considered to have relatively similar academic abilities. Therefore, cluster random sampling was employed to select two classes, as suggested by Fraenkel et al. (2012). Class VII.A (n = 32) and Class VII.C (n = 31), with students aged between 12 and 13 years, were chosen. Class VII.A was assigned to the Wordwall group, and Class VII.C to the Educaplay group. Although cluster random sampling was used, the number of students per class was not proportionally adjusted. This may influence generalizability and estimation accuracy, as highlighted by Xiong & Higgins (2020), who emphasized that "by sampling clusters with probability proportional to the number of units within a cluster, the Horvitz-Thompson estimator (HT) is invariant to location shifts and unbiasedly estimates PATE" (p. 124). Therefore, future studies should consider incorporating probability-proportional-to-size (PPS) sampling when cluster sizes vary meaningfully.

Both classes received the same learning material on the topic of Ecology and Biodiversity in Indonesia. Instruction was delivered in eight face-to-face sessions by the same teacher, who was also the researcher. Facilities, duration of lessons, and classroom conditions were kept consistent between the two groups. Digital quizzes were administered during the teaching process in each class, except for the final task, which was completed outside of regular class hours. The number of quiz templates per meeting ranged from two to six, depending on the subtopic, and the total number of activities was balanced between both classes.

Students' creative thinking skills were assessed using a pretest at the beginning and a posttest at the end of the intervention. Each test session lasted 40 minutes (one school period) and was conducted simultaneously in both groups from 13:15 to 14:00. To ensure equal testing conditions, students worked on identical printed test sheets containing the same questions, and seating was arranged to minimize distractions.

The instrument used to measure creative thinking consisted of four essay items, each designed to assess one of the four dimensions of creative thinking as proposed fluency, flexibility, originality, and elaboration. An analytic scoring rubric with a 0 to 5 scale was used to evaluate students' responses, supported by specific descriptors for each score level.

The instrument underwent expert validation by two professors. Prof. Dr. Nurhayati B., M.Pd., a biology education expert at UNM, and Prof. Dr. Firdaus Daud, an expert in educational evaluation at FMIPA UNM, evaluated the instrument in terms of content accuracy, item construction, and language clarity. Validation scores averaged 4.25 for content, 4.50 for item construction, and 4.33 for language, indicating strong validity and appropriateness for use in this study.

Data from the pretest and posttest were processed using Microsoft Excel and analyzed with IBM SPSS Statistics version 23. Descriptive statistics were used to summarize the results, while inferential statistics were applied to test the hypothesis. Analysis of Covariance (ANCOVA) was used to determine whether there was a significant difference in creative thinking skills between the two groups after controlling for pretest scores. Prior to conducting ANCOVA, several assumptions were tested: (1) normality of residuals using the Shapiro–Wilk test ($p > 0.05$), (2) homogeneity of variance using Levene's test ($p > 0.05$), (3) linearity between the covariate and dependent variable assessed through scatter plots, and (4) homogeneity of regression slopes, confirmed if the interaction between group and covariate was not significant ($p > 0.05$) (Huitema, 2011). If any of these assumptions were violated, Quade's Rank ANCOVA was employed as a non-parametric alternative, as (Thompson, 2023).

## Result and Discussion

The results of the descriptive analysis of students' creative thinking skills before and after the learning process using Wordwall and Educaplay are presented in Table 1.

Based on Table 1, the pretest mean score of creative thinking skills in the Wordwall class was 29.62 ± 15.24, while the posttest mean score was 49.53 ± 18.55. The adjusted mean score, after controlling for the covariate, was 49.30 ± 2.607. In the Educaplay class, the pretest mean score was 28.97 ± 13.63, and the posttest mean score was 48.06 ± 17.06. The adjusted mean score for this group was 48.30 ± 2.648.

**Table 1.** Descriptive Analysis of Students' Creative Thinking Skills

| Class | Pretest | | Posttest | | Improv | Adj. Mean | SD |
|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | | | |
| Educaplay | 28.97 | 13.63 | 48.06 | 17.06 | 66% | 48.30 | 2.65 |
| Wordwall | 29.62 | 15.24 | 49.53 | 18.55 | 67% | 49.30 | 2.61 |

The frequency distribution and categorical levels of creative thinking skills in the Wordwall class are presented in Table 2.

**Table 2.** Frequency Distribution and Categories of Students' Creative Thinking Skill Scores in the Wordwall Class

| Interval | Category | Pretest | | Posttest | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| 81 – 100 | Very Creative | 0 | 0.00 | 2 | 6.30 |
| 61 – 80 | Creative | 0 | 0.00 | 6 | 18.80 |
| 41 – 60 | Moderately Creative | 7 | 21.90 | 11 | 34.40 |
| 21 – 40 | Less Creative | 15 | 46.90 | 12 | 37.50 |
| 0 – 20 | Not Creative | 10 | 31.30 | 1 | 3.10 |

As shown in Table 2, the descriptive analysis indicates that, prior to the intervention, the number of students in the Wordwall class categorized as "not creative" was 10 students (31.30%), "less creative" was 15 students (46.90%), and "moderately creative" was 7 students (21.90%). After the intervention, posttest results show a reduction in the number of students categorized as "not creative" to only 1 student (3.10%), while 12 students (37.50%) were in the "less creative" category, 11 students (34.40%) in the "moderately creative" category, and 6 students (18.80%) reached the "creative" category. These results suggest that the implementation of Wordwall contributed to an improvement in students' creative thinking skills in the Wordwall experimental group, although the number of students reaching higher categories remains relatively modest.

The frequency distribution and categorical levels of creative thinking skills in the Educaplay experimental class are presented in Table 3.

**Table 3.** Frequency Distribution and Categories of Students' Creative Thinking Skill Scores in the Educaplay Class

| Interval | Category | Pretest | | Posttest | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| 81 – 100 | Very Creative | 0 | 0.00 | 1 | 3.20 |
| 61 – 80 | Creative | 0 | 0.00 | 5 | 16.10 |
| 41 – 60 | Moderately Creative | 6 | 19.40 | 15 | 48.40 |
| 21 – 40 | Less Creative | 13 | 41.90 | 7 | 22.60 |
| 0 – 20 | Not Creative | 12 | 38.70 | 3 | 9.70 |

Based on Table 3, the results of the descriptive analysis indicate that, during the pretest, the number of students whose creative thinking skills fell into the *Not Creative* category was 12 students (38.70%), *Less Creative* was 13 students (41.90%), and *Moderately* Creative was 6 students (19.40%). In the posttest, the number of students in the *Not Creative* category decreased to 3 (9.70%), while those in the *Less Creative* category were 7 (22.60%). The number of students in the *Moderately Creative* category increased to 15 (48.40%), and those in the *Creative* category rose to 5 students (16.10%). These results suggest that the implementation of Educaplay effectively improved the creative thinking skills of students in the Educaplay experimental group.

To facilitate the interpretation of the data distribution presented in Table 2 and Table 3, a distribution diagram is provided in Figure 1.

Inferential statistical procedures were applied to test the research hypotheses. Before conducting hypothesis testing, assumption tests were carried out to determine whether parametric or non-parametric statistical methods should be used. The results of the assumption tests are presented.

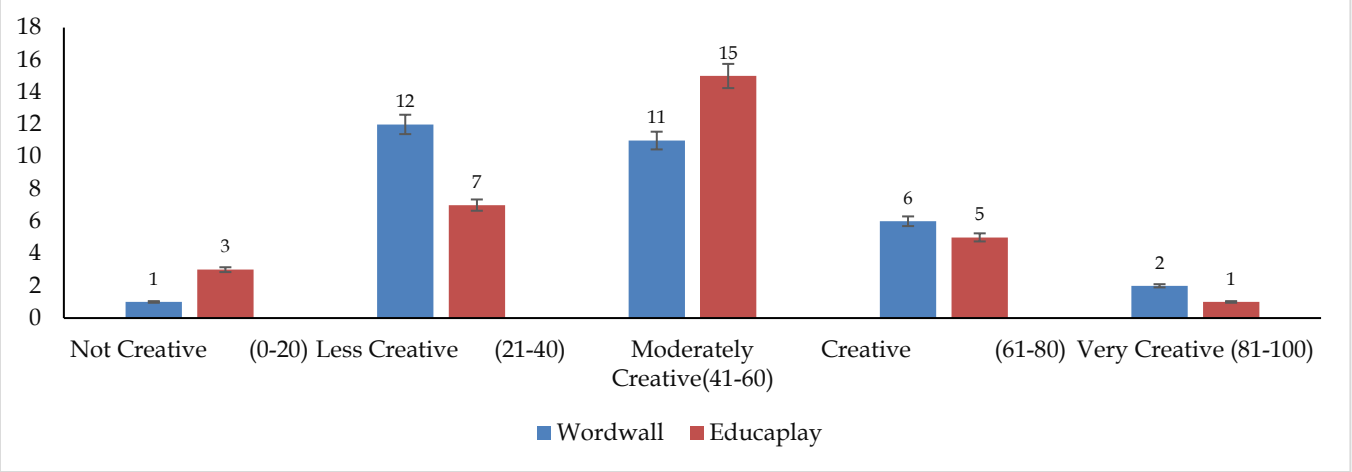


**Figure 1.** Frequency Distribution Diagram of Students' Creative Thinking Scores in the Posttest across Both Groups

*Normality Test Results*: The results of the Shapiro-Wilk test indicated that the residual data for students' creative thinking skills were normally distributed ($D(63) = 0.981$, $p = 0.429 > 0.05$). *Homogeneity Test Results:* The results of the Levene's test showed that the variance in creative thinking skill scores between the Wordwall class and the Educaplay class was homogeneous [$F(1, 61) = 2.481$, $p = 0.120 > 0.05$]. *Linearity Test Results:* In each class, the pretest data (covariate) were linearly related to the posttest data (dependent variable) of creative thinking skills. *Homogeneity of Regression Slopes:* The regression slopes between the pretest and posttest scores of creative thinking skills in the Wordwall and Educaplay classes were found to be homogeneous [$F(1, 59) = 0.000$, $p = 0.994 > 0.05$].

Since all assumptions were met, a one-way parametric ANCOVA was conducted, controlling for the effect of the covariate variable, namely the students' initial creative thinking skill scores (pretest).

**Table 4.** ANCOVA Results of Creative Thinking Skills between the Wordwall and Educaplay Classes

| Source | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|
| Class | 1 | 15.58 | 0.07 | 0.79 | 0.001 |
| Error | 60 | 213.68 | | | |

The results of the one-way ANCOVA showed that there was no significant difference in creative thinking skills between students taught using Wordwall and those taught using Educaplay after controlling for the covariate, which was students' initial creative thinking skills [$F(1, 60) = 0.073$, $p = 0.788 > 0.05$, $\eta p^2 = 0.001$]. Based on Table 1, the adjusted mean of creative thinking skills in the Wordwall class (49.30) appeared slightly higher than that of the Educaplay class (48.30). However, the hypothesis test results indicate that the difference was not statistically significant, as can be seen in Table 4. This analysis is further illustrated in Figure 1, which presents the distribution of students across different levels of creative thinking skills. In both the Wordwall and Educaplay classes, the majority of students fell into the 'Moderately Creative' category.

Figure 1 indicates that both the Wordwall and Educaplay groups fall within the "moderately creative" category, with the Wordwall group exhibiting a slightly higher proportion of students categorized as "less creative." This finding suggests that although quiz-based digital media such as Wordwall and Educaplay have the potential to enhance learning quality, their impact on students' creative thinking skills remains limited when not accompanied by appropriate instructional design. In this study, both media were applied through conventional teaching steps, without integration into a structured pedagogical model that specifically fosters creativity.

Previous research has consistently emphasized that the effectiveness of digital learning media in developing higher-order thinking skills and 21st-century competencies is highly dependent on the instructional framework in which the media are embedded. For instance, Hadis & Nurhayati (2018) reported that science process skill-based learning not only enhances students' understanding of scientific content but also promotes higher-order thinking abilities such as problem solving, data analysis, and creative exploration. They further highlighted that the successful implementation of such learning requires systematically validated instructional tools—such as lesson plans, modules, and assessments—that are aligned with student-centered pedagogical approaches.

This perspective is reinforced by Lafifa & Rosana (2023), who demonstrated that animation-based science learning media integrated with the STEM-PBL model were both valid and practical, and significantly improved students' critical thinking and digital literacy. Aunurofiq & Setyasto (2025) also found that a Problem-Based Learning model supported by Augmented Reality was more effective in improving science learning

outcomes than the same model using static image-based materials. Similarly, Putri et al. (2023) reported that Wordwall significantly improved students' critical thinking skills, but only when implemented within a structured cooperative learning model such as STAD. Their findings suggest that interactive platforms like Wordwall yield optimal results when combined with active learning strategies that promote collaboration and deep engagement with content.

This finding is consistent with the statement by Hamari et al. (2014) that although gamification can increase motivation, its impact on higher-order thinking skills such as creative thinking is not always significantly different across platforms. One possible reason for the lack of significant difference is that Wordwall and Educaplay share similar features in terms of question types and interactivity. As a result, they may not provide substantially different cognitive stimulation for fostering originality, flexibility, and elaboration in students' ideas. For example, quiz games on both platforms are comparable. Wordwall includes the Balloon Pop feature, which is considered engaging due to its visual and auditory stimuli and its ability to create a competitive atmosphere that motivates students to learn more enthusiastically. Likewise, Froggy Jumps on Educaplay is designed to enhance student motivation and engagement through visually attractive graphics and enjoyable challenges (Mujahidah & Mailani, 2025)

However, previous research has shown that Wordwall can contribute positively to students' creative thinking and conceptual understanding when integrated effectively into classroom practice (Widodo et al., 2025). For instance, Bahia (2023) reported that "the use of the Word Wall learning media in a blended learning environment showed a significant improvement in students' creative thinking skills. The interactive nature of the game-based platform encouraged idea generation, imaginative exploration, and flexible thinking during the learning process" (p. 56). This suggests that the potential of Wordwall to enhance creativity is more likely to be realized when the platform is implemented within a deliberate instructional framework that nurtures creative exploration.

Apart from feature similarity, another possible reason for the non-significant difference is that the researcher used similar words, phrases, and sentence structures in the question design on both platforms. Therefore, the most noticeable variation may only be the visual template of the games.

Several studies have confirmed the importance of using both Wordwall and Educaplay in classroom learning. Saputri et al. (2022) found that Wordwall positively influenced students' higher-order thinking skills. This finding is in line with Rudianto & Fauziah (2024), who reported that students' responses to the use of Wordwall were highly positive, with an acceptance rate of 92.5 percent, and that the platform improved students' creative thinking skills. Similarly, a study by Batitusta & Hardinata (2024) revealed that technology-based media, particularly Educaplay, improved students' performance in writing essays. Another advantage of Educaplay is that students who learned using this platform showed better concept understanding and higher learning motivation than those who learned through conventional methods. Given the effectiveness of both media and the absence of a significant difference between them, Wordwall and Educaplay can be considered suitable options for instruction depending on user needs and classroom context.

For teachers in Indonesia, selecting between Wordwall and Educaplay should also consider the accessibility and practicality of the payment system. Wordwall may be a more suitable choice for users unfamiliar with PayPal, as its premium account can be purchased via popular e-commerce platforms in Indonesia. However, the free version of Wordwall does not allow repeated use of created materials. In contrast, Educaplay requires a PayPal payment to access premium features. Since PayPal is not commonly used in Indonesia, this may not be convenient for many teachers. Nonetheless, Educaplay allows repeated use in its free version, although with certain limitations, such as a waiting time of approximately 50 minutes after creating one activity before creating. For instance, if a teacher creates an ecology quiz using Froggy Jumps, they must wait before designing a new quiz on biodiversity. Therefore, the main considerations when choosing a platform should include the availability of free features, ease of transaction, and time efficiency.

Despite the growing number of studies supporting the benefits of Wordwall and Educaplay in education, the limitations of this study must be acknowledged. Although Table 1 shows an increase in creative thinking skills, the absence of a control group is a limitation. This study involved two experimental classes, one using Wordwall and the other using Educaplay, to compare their effects. Future researchers are encouraged to include three groups by adding a control group that uses conventional learning. This would allow a clearer comparison of the effect of both media and provide a better understanding of how each platform contributes to students' creative thinking development.

## Conclusion

Based on the results of the study, it can be concluded that there was no significant difference in the

creative thinking skills of seventh-grade students in science learning between those taught using Wordwall and those using Educaplay. Both platforms proved equally effective in enhancing students' creative thinking skills. Therefore, either Wordwall or Educaplay can be utilized as engaging and interactive media to support science learning at the junior high school level.

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N.B., M.P., M.T. and F.D., supervised the writing of the article, reviewed, and validated the research instruments used. E., created the research concept, research procedures, analyzed the data, and wrote the article.

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**Conflict of Interest**
The authors declare no conflict of interest.

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