Enhancing mathematics learning outcomes through wordwall-based culturally responsive teaching

Dinda Nur Salsabila[1*], Mary Gyenin[2], Nani Ratnaningsih[3]

[1]Universitas Pasundan, Bandung, Indonesia
[2]Akenten Appiah Menka University of Skills Training and Entrepreneurial Development, Kumasi, Ghana
[3]Universitas Siliwangi, Tasikmalaya, Indonesia
*Email: dindanursalsabila1912@gmail.com

Abstract

This study aims to enhance students' mathematics learning outcomes on exponent material through the use of Wordwall media integrated with the Culturally Responsive Teaching (CRT) approach at SMA Negeri 3 Tasikmalaya. The research employed a Classroom Action Research (CAR) method, conducted in two cycles with a total of 36 student participants. Data collection techniques included observation and formative assessments, using observation sheets and test instruments to evaluate both the learning process and outcomes. The findings revealed significant improvements in students' learning outcomes following the implementation of Wordwall-based CRT learning. In the pre-cycle, the average student score was 55, with only 22.22% meeting the Learning Objective Completion Criteria. After the first cycle, the average score increased to 77, with 70% of students meeting the KKTP. By the second cycle, the average score rose to 87, with 90% of students achieving the learning criteria. These results suggest that integrating digital interactive media with culturally responsive pedagogy can effectively improve students' conceptual understanding and overall learning performance. Furthermore, the CRT approach contributed to increased student engagement, motivation, and active participation, creating a more inclusive and contextual learning environment that supports the diverse needs of learners in mastering the concept of exponents.

Keywords: Culture-Based Approach, Culturally Responsive Teaching, Learning Innovation, Mathematics Learning Outcomes, Wordwall Media

How to Cite: Salsabila, D.N., Gyenin, M., & Ratnaningsih, N. (2025). Enhancing mathematics learning outcomes through wordwall-based culturally responsive teaching. *Pasundan Journal of Mathematics Education, 15*(1), 16-31. http://doi.org/10.23969/pjme.v15i1.24200

INTRODUCTION

Mathematics is a tool that helps students face problems and challenges in various aspects of personal life, society, and work (Jannah & Hayati, 2024). Educators, especially mathematics teachers, are expected to design learning experiences that are not only effective and efficient but also contextual, enabling students to relate the material to everyday life and develop critical and creative thinking skills. as expressed by Kurniati et al (2015) contextual teaching and learning approach enhances mathematical critical thinking ability better than the traditional teaching and learning approach.

However, students' achievement in mathematics in Indonesia remains relatively low. According to a survey conducted by Beatty et al. (2021), Learning in mathematics in Indonesia declined by a fourth of a standard deviation from 2000 to 2014, affecting all subgroups. The latest data from the Programme for International Student Assessment (PISA) in 2022 also indicate that Indonesian students' mathematics performance remains below the average of participating countries (OECD, 2023). One contributing factor is the lack of active student engagement in the learning process and the use of instructional media and

approaches that fail to spark interest or bridge students' understanding of abstract mathematical concepts (Fahlevi, 2022). To address this, educators are encouraged to use learning media that enable students to interact directly with the content (Nurfadhillah et al., 2021). Afandi et al. (2016) argued that technological advancements have brought transformative changes in education not only in terms of curriculum content but also pedagogy by encouraging the development of technology-based teaching beyond traditional methods.

PISA results show that Indonesian students' literacy, numeracy, and science skills are still below international standards. One of the factors behind this is the suboptimal quality of teachers. The 2024 Competency Assessment of Madrasah Teachers and Educational Personnel revealed that many teachers still face limitations in pedagogical, literacy, and numeracy aspects (Alfaruqi & Nurwahidah, 2025). Achieving educational goals in schools is highly dependent on the role of teachers, who are responsible not only for students' academic development but also for their future success, which is a major expectation of parents (Nuraridha et al., 2024).

According to Permana (2022), Wordwall is a tool that can be used to assess student learning. The platform offers various assessment formats such as categorization, short essays, matching, and quizzes each with distinct advantages. Rosdiani (2021) explains that Wordwall is a website that allows teachers to create interactive learning templates in the form of games. Observations and cognitive diagnostic assessments at SMA Negeri 3 Tasikmalaya show that most students struggle to understand exponent material, with only 44.5% achieving mastery. This highlights the need to improve the quality of learning through approaches and media that increase student engagement and provide enjoyable and contextual learning experiences. This aligns with previous research (Sari et al., 2023; Kristanto, 2020; Pramesti, 2025; Gumilar et al., 2024; Luluk, 2024), which found that mathematics learning quality can be enhanced through the application of innovative strategies such as gamification-based flipped classrooms supported by proper supervision and the provision of meaningful learning challenges to boost intrinsic motivation.

This study utilizes Wordwall, an online tool that supports game-based learning like Kahoot and Quizzes (Arifah et al., 2023). Susanto & Sari (2023) found that Wordwall learning media (X) has a significant effect on student learning outcomes. Wordwall media has a 79.4% effect on learning outcomes and 58.9% effect on interest in learning (Hidayaty, Qurbaniah, & Setiadi, 2022). Wordwall offers free access to a range of templates suited to different instructional needs (Firdaus & Rulviana, 2024). According to Virliana (2024), Wordwall can be used as a learning resource, medium, and evaluation tool. Shiddiq (2021) describes it as a web-based application for creating educational games and engaging quizzes. One of its strengths is that it offers free access, requiring only email registration, and provides a variety of templates (Rika et al., 2024). Previous studies have shown that Wordwall can enhance both student learning outcomes and engagement (Akbar & Hadi, 2023; Kurniasih, 2021). However, its use has rarely been linked with pedagogical approaches that consider students' cultural backgrounds. The Culturally Responsive Teaching (CRT) approach is a pedagogical strategy that incorporates students' cultural identities into the learning process. Originally developed by Gloria Ladson-Billings and later expanded by Geneva Gay (2000), CRT seeks to improve academic achievement while affirming students' cultural heritage. Geneva Gay (2002) added five essential components, including cultural diversity awareness, curriculum integration of cultural content, and building inclusive learning environments. As Khalisah et al. (2024) assert, CRT integrates students' cultural backgrounds into learning design.

Wordwall offers various interactive methods tailored to diverse student needs (Tasya et al., 2025). According to Widianto (2021), Wordwall quizzes can increase student interest and foster critical thinking through enjoyable activities. The platform allows students to actively participate in their learning process

(Purnamasari et al., 2022). It provides engaging formats such as matching games, flashcards, and quizzes (Pinta et al., 2024; Rohman, 2024). The CRT approach stresses the importance of valuing students' cultural identities in the classroom (Asmaliyah et al., 2025). Wordwall enhances understanding by offering visual representations that simplify complex mathematical concepts (Hansa & Muthi, 2024). This supports Markey et al. (2021) Culturally responsive teaching, understanding student learning needs and vulnerabilities, facilitating respectful discussions, challenging assumptions, and encouraging intercultural dialogue are crucial for nurturing intercultural inclusiveness in nursing classrooms. Sari, Sari & Namira (2023) affirm that integrating culture into classroom content aids comprehension. Rahmawati et al. (2017) outlined the CRT implementation steps: (1) self-identification through apperception and diverse group formation, (2) cultural understanding by integrating cultural content into materials, (3) student-teacher collaboration, (4) critical thinking through projects, and (5) transformative construction via group presentations. CRT is relevant because it considers students' cultural habits and regional backgrounds (Firdausy et al., 2024). It has been shown to improve learning outcomes (Putri & Selviari, 2024). Astuti (2023) demonstrated that integrating local wisdom into math learning enhances interest and conceptual understanding, though research on combining CRT with Wordwall remains limited. CRT offers meaningful learning experiences by recognizing cultural diversity and embedding it into instructional materials (Enjelina et al., 2024).

This is reinforced by Latipia Damayanti's classroom action research, which showed an increase in PPKN learning outcomes from 54% in the first cycle to 92% in the third (Damayanti et al., 2023). Similarly, Nuryatmi Afrianti's research revealed improvement in mathematics outcomes from 33% (pre-cycle), to 60% (cycle I), and 90% (cycle II) using CRT (Afrianti, 2024). By combining CRT and Wordwall, teachers can create digital game-based learning activities that are visually engaging, interactive, and culturally relevant. CRT principles, such as building effective communication, understanding students' learning styles, and designing culturally aligned materials, can be implemented through Wordwall features. The synergy between CRT and Wordwall lies in their shared objective: to create relevant, enjoyable, and meaningful learning experiences. Mujahidin et al. (2021) found that appropriate use of media enhances student interest, engagement, and achievement. Molita et al. (2023) showed that CRT implementation improved learning outcomes, from 22% (pre-cycle), to 91.6% (Cycle I), and 97.22% (Cycle II). Integrating cultural context into learning significantly boosts motivation, engagement, and content comprehension.

The research gap addressed in this study is the lack of research that specifically integrates Wordwall as interactive digital media with the Culturally Responsive Teaching approach in mathematics learning, particularly in teaching exponents at the high school level. Previous studies have focused separately on the effectiveness of Wordwall or the implementation of CRT without incorporating digital media. CRT is a culturally grounded pedagogical approach (Gay, 2000; Kerrigan et al., 2020; Comstock et al., 2023). In mathematics, CRT can support deeper conceptual understanding by connecting material to students' cultural backgrounds (Wardana et al., 2024). Therefore, this study makes a valuable contribution by proposing a model that merges digital technology with culturally responsive pedagogy. Based on the above explanation, this research aims to improve the mathematics learning outcomes of Grade 10 students at SMA Negeri 3 Tasikmalaya on exponent material through the application of Wordwall integrated with the Culturally Responsive Teaching (CRT) approach using Classroom Action Research (CAR).

METHODS

This study is a Classroom Action Research (CAR) conducted at SMA Negeri 3 Tasikmalaya, involving 36 tenth-grade students as research subjects, consisting of 24 female and 12 male students. Classroom Action Research is a reflective process in which teachers assess student comprehension, evaluate the school curriculum, examine instructional methods and techniques, and monitor students' academic development and learning outcomes (Utomo, 2024). It integrates systematic research procedures with concrete classroom actions measures undertaken within a disciplined inquiry to understand ongoing classroom dynamics while aiming for improvement and change (Fauzi et al., 2024).

Based on the results of an initial cognitive diagnostic assessment on the topic of exponents, it was found that students' prior knowledge was relatively low. This is evident from the learning mastery rate, which reached only 44.5%, indicating that most students had not yet developed a solid understanding of the basic concepts of exponents.

These conditions highlight the need to improve the learning process by employing more interactive and contextual approaches and media. A Culturally Responsive Teaching (CRT) approach was systematically applied in mathematics instruction, particularly in the topic of exponents. Rahmawati et al. (2017) outline the steps for implementing CRT as follows: (1) Fostering self-identification through apperception and the formation of diverse groups; (2) Enhancing cultural understanding by incorporating cultural content into instructional materials; (3) Promoting collaboration between students and teachers in the learning process; (4) Developing critical thinking skills through project-based learning; and (5) Applying transformative learning through group presentations. The replicable steps for implementation of culturally responsive teaching are organized in several stages. First, teachers begin by identifying student culture and characteristics. This is done through observation and short interviews to gather information about students' local cultural backgrounds, including customs, local languages, and social values relevant to their daily lives. Next, the process moves into cultural-contextual learning planning. At this stage, teachers prepare instructional tools that incorporate local cultural elements into mathematics content. For example, they might use word problems or case studies involving local economic activities, such as calculating crop yields (exponents), determining the number of extended family members, or modeling social growth using exponential concepts.

In the next stage, teachers utilize interactive Wordwall media based on local culture. Wordwall is chosen due to its flexibility in creating quizzes, matching games, anagrams, and other interactive activities that can be tailored to the students' cultural contexts. It also promotes collaborative learning and enhances active student participation. The implementation of learning is carried out in an interactive and reflective manner. Teachers facilitate group discussions that connect mathematical concepts with cultural realities and guide students in solving contextual problems using games created on the Wordwall platform. These activities are enriched with both group and individual reflections, enabling students to better understand the relevance of the learning material to their everyday lives.

Finally, the evaluation process is designed to be culturally responsive. Teachers provide personalized feedback by considering students' thought processes, which are influenced by their respective cultural backgrounds. Evaluations are conducted through formative assessments, observations of student engagement, and reflective questionnaires that explore students' learning experiences throughout the implementation of the Culturally Responsive Teaching (CRT) approach.

Susilowati (2018) stated that "Classroom Action Research is a type of research that uses a continuous cycle, making it impossible for a single classroom action research study to consist of only one

cycle." The purpose of these cycles is to validate and refine actions as solutions to research problems (Prihantoro & Hidayat, 2019). The primary instrument used to measure learning outcomes was a descriptive test on exponent material, which included indicators of conceptual understanding and the ability to apply concepts in real-life contexts. In addition, a survey instrument in the form of a questionnaire, typical of quantitative methods, was distributed to obtain numerical data that could be analyzed and interpreted (Indrawan & Yaniawati, 2016). This instrument was validated by two expert lecturers in mathematics education and one experienced mathematics teacher using a content validity approach. The validation results indicated that the test items were aligned with the learning objectives and were relevant to the local cultural context. The reliability of the instrument was tested using the Cronbach's Alpha formula, based on a trial conducted in a different class with similar characteristics. The results yielded a reliability coefficient of 0.81, indicating that the instrument falls within the high reliability category. The procedures and stages of this Classroom Action Research were adapted from the Kemmis and McTaggart model, which involves multiple cycles. Each cycle consisted of the following phases: planning, implementation and observation, evaluation, and reflection. These were conducted based on specific indicators targeted in each aspect under investigation (Mulyati & Evendi, 2020).

Table 1. Student Learning Completion Score Criteria

Learning Objective Achievement Criteria (KKTP)	Value Range
Very good	$90 \leq \text{kb} < 100$
Good	$80 \leq \text{kb} < 90$
Medium/Enough	$70 \leq \text{kb} < 80$
Not enough	$45 \leq \text{kb} < 70$
Very less	$0 \leq \text{kb} < 45$

The main instrument used to measure learning outcomes was a descriptive test on exponent material, which included indicators of conceptual understanding and the ability to apply concepts in real-life contexts. Additionally, a survey instrument in the form of a questionnaire, typical of quantitative methods, was distributed to obtain numerical data for further analysis and interpretation (Indrawan & Yaniawati, 2016). This instrument was validated by two expert lecturers in mathematics education and one experienced mathematics teacher using a content validity approach. The validation results confirmed that the test items aligned with the learning objectives and were relevant to the local cultural context. The instrument's reliability was tested using the Cronbach's Alpha formula, based on a pilot trial conducted in another class with similar characteristics. The results showed a reliability coefficient of 0.81, indicating that the instrument belonged to the high reliability category.

Data analysis in this study employed both descriptive and inferential quantitative methods. Descriptive analysis was used to describe the progression of students' learning outcomes across each cycle. The data analyzed included learning test scores, student activity observation sheets, and reflection questionnaires. Inferential analysis was conducted using a paired sample t-test to compare pretest and posttest scores from the initial and final cycles. This statistical test aimed to determine whether there was a significant difference between students' initial abilities and their learning outcomes after the implementation of the Wordwall-assisted CRT approach. The t-test was conducted using statistical software (e.g., SPSS), with a significance level set at $\alpha = 0.05$. If the significance value (p-value) was less than 0.05, it was concluded that the Wordwall-assisted CRT approach had a significant effect on improving students' mathematics learning outcomes.

Through this approach and method of analysis, it is expected that mathematics learning becomes more meaningful, contextual, and capable of enhancing students' understanding and motivation, particularly in mastering exponent material.

RESULTS AND DISCUSSION

The results of the study indicate that the integration of Culturally Responsive Teaching (CRT) with the support of interactive technology such as Wordwall can enhance student engagement, making the learning process more interactive and increasing students' interest in learning (Agusti & Aslam, 2022). Furthermore, the findings offer insights into the significance of culturally adaptive instructional strategies and the effective use of technology in facilitating learning. Using Wordwall media significantly improves science learning outcomes and learning motivation, creating a more interactive and fun learning atmosphere for students (Lestari & Rohmani., 2024). Using engaging teaching methods and learning principles can optimize students' ability to learn and motivate, resulting in a fun, comfortable, and enjoyable learning experience (Suwarni et al., 2024).

The pre-cycle stage aimed to determine students' initial abilities before the implementation of the CRT approach (Mutiaratri et al., 2024). Data were collected through observations, interviews, and document analysis. The pre-cycle activities were carried out at SMA Negeri 3 Tasikmalaya with a total of 36 students. Observational data showed that the teaching process was still predominantly conventional, relying heavily on textbooks. Teachers tended to use lecture-based methods, question-and-answer sessions, and written assignments, with limited variation in teaching strategies or media. Monotonous teaching methods and lack of teacher engagement are primary factors contributing to student boredom in elementary schools (Tul'adawiyah, Nurihsan, & Budiman, 2024).

Interviews with mathematics teachers revealed that many students struggled to grasp the concept of exponents, especially in a learning environment dominated by lecture methods and textbook use. This aligns with findings by Tangkoro et al. (2024), who reported that students' understanding of exponent material remains weak, leading to difficulties in solving problems when assessed, especially if the problems differ slightly from textbook examples. Interviews with students also revealed similar challenges: they found it difficult to independently understand exponent concepts through passive reading, especially without the support of engaging media or varied instructional methods.

Wahyuningsih et al. (2024) further observed that students tend to make mistakes when solving problems, particularly when the format of the question differs from the examples previously provided. In such cases, students become confused and take a longer time to complete the tasks. This is consistent with the findings of Pinahayu (2016), who reported that students' difficulties in mastering exponent material stem from limited conceptual understanding, challenges in performing arithmetic operations, and general carelessness during problem-solving. Document analysis in the form of students' cognitive diagnostic test results also confirmed that the level of classical mastery was still low. Out of 36 students, only 5 students (13.8%) met the minimum learning mastery standard of 75. The detailed results are presented as follows.

Table 2. Pre-Cycle Test Results for Students

Learning Objective Achievement Criteria	Value Range
Very Food	-
Good	1 (0,3%)
Medium/Enough	4 (11,2%)
Not enough	21 (58,3%)
Very less	11 (30,2%)

In the pre-cycle stage, the results of observations served as the foundation for designing and implementing instructional improvements in cycle I. The primary objective of cycle I was to enhance student learning outcomes through the implementation of the Culturally Responsive Teaching (CRT) approach, supported by the integration of Wordwall media. According to Tsai, Lindo, & Bridges (2021), CRT in medical education teaches learners how to abolish biological racism, leverage historical contexts of oppression, and understand the institutional mechanisms and ubiquity of racism. Meanwhile, Wordwall is a web-based application that enables educators to create interactive learning media such as quizzes, matching games, word searches, anagrams, grouping tasks, and more.

The planning phase involved a range of preparatory activities, including the development of teaching modules tailored to Grade X exponent material, the preparation of instructional media using Canva Slides integrated with Wordwall, and the provision of student worksheets, evaluation tools, and assessment instruments to monitor learning progress. The CRT approach was employed to make learning more culturally relevant, thereby increasing students' engagement by connecting the content with their lived experiences. Wahira (2024) notes that CRT facilitates a better understanding of learners from diverse cultural backgrounds and helps strengthen the relationship between schools and local communities. Schools become more attuned to students' socio-cultural contexts, which in turn enhances the effectiveness of instruction. Siwatu (2011) identify the following characteristics of CRT: (1) recognition and appreciation of students' cultural backgrounds; (2) incorporation of all aspects of learning; (3) integration across the curriculum, learning environments, interpersonal interactions, teaching methods, and assessment; (4) continuous development based on students' socio-cultural contexts; and (5) empowerment of students to achieve both academic and personal success.

In Cycle I, learning activities were implemented in three stages introduction, core, and closing across two classroom meetings, beginning on September 2, 2024. A total of 36 students participated in the lessons. The core learning stage was designed to be interactive, featuring the presentation of exponent material using Canva Slides embedded with Wordwall-based games. This was followed by a teacher-guided Q&A session to foster active participation, collaborative group work to complete learning tasks, peer discussions, and presentations of group findings, and finally, an individual evaluation to assess conceptual understanding.

The use of Canva and similar digital tools has been found to support the development of student-centered instructional strategies (Mursalin et. al., 2024). Engaging and interactive visual materials created with such platforms can spark student interest and facilitate active participation (Gunawan et al., 2024; Silitonga & Siahaan, 2024). This approach aligns with current educational paradigms that prioritize student engagement and active learning (Arifin et al., 2024; Martini et al., 2023; Partasiwi et al., 2023; Pratiwi et al., 2023).

Observations involved direct monitoring of activities in the learning environment, Students' sensory learning styles are implemented in the creation of differentiated content, with factors like teacher's educational background and teaching practices contributing to the success (Sulistianingrum et al., 2023).

Observation tasks were conducted by two observers: the mathematics teacher and a peer colleague. Findings indicated that some students were still inattentive during explanations, and several experienced difficulties understanding the exponent material. A number of students also exhibited a lack of confidence when presenting group discussion outcomes in front of the class. Moreover, as the CRT approach supported by Wordwall was relatively new to them, students required time to adjust to this instructional method. Although an improvement in learning outcomes was observed, the majority of students had not yet reached the minimum mastery threshold of 75. The detailed results of Cycle I are presented in the following table.

Table 3. Results of Cycle I Student Tests

Learning Objective Achievement Criteria	Value Range
Very good	-
Good	8 (22,2%)
Medium/Enough	10 (27,78%)
Not enough	12 (33,3%)
Very less	6 (16,67%)

The results of the data analysis show that the distribution of learning objective achievement was still dominated by categories indicating the need for improvement, with the largest proportion falling below the optimal achievement level. This suggests a need to strengthen learning strategies and implement more effective interventions to help students achieve better outcomes. Although a small group of students demonstrated adequate performance, the overall results highlight the importance of improving quality to ensure a more equitable level of success among all learners.

In Cycle II, corrective actions were taken based on the reflection results from Cycle I. The main objective remained to improve student learning outcomes through the refinement of the Culturally Responsive Teaching (CRT) approach, supported by Wordwall media. Several improvements were introduced. A more interactive learning atmosphere was created by incorporating ice-breaker activities at the beginning of lessons to boost students' motivation and enthusiasm. Collaborative learning techniques were further emphasized to increase active student participation, particularly during group discussions and presentations. More intensive support was provided in the form of individual guidance for students who struggled to understand the exponent material. Additionally, question-and-answer sessions were conducted in a more structured manner to address students' specific learning needs.

A wider variety of learning media was also employed by integrating Wordwall-based games with elements of competition to make learning more engaging. The delivery of material was enriched through interactive animations embedded in PowerPoint presentations. To better assess students' progress, evaluation questions were refined to match appropriate difficulty levels and more accurately measure improvements in understanding. After these corrective actions were implemented, student learning outcomes showed a significant increase. The results of student achievement in Cycle II are presented in the following table:

Table 4. Results of Cycle II Student Tests

Learning Objective Achievement Criteria	Value Range
Very good	10 (27,78%)
Good	15 (41,67%)
Medium/Enough	8 (22,22%)
Not enough	3 (8,33%)
Very less	0 (0%)

Data analysis indicates that the achievement of learning objectives reached a fairly satisfactory level, with the majority of students attaining good or very good results. This reflects the effectiveness of the implemented learning approach. However, there are still students whose results fall into the moderate and poor categories, suggesting the need for further enhancement of learning strategies to ensure more equitable achievement across the classroom. The absence of students in the very poor category is a positive indicator of the overall success of the program implementation.

The application of the improved strategy specifically, the integration of the Culturally Responsive Teaching (CRT) approach supported by Wordwall media proved effective in enhancing student learning outcomes. Students demonstrated significant improvement in enthusiasm, a deeper understanding of exponent material, and greater self-confidence when presenting the results of group discussions. The outcomes of Cycle II indicate that the learning intervention successfully achieved the intended goals.

The CRT approach, when supported by Wordwall media, made the exponent material more concrete, relevant, and engaging for students. The cultural component of this approach connects learning content to students' values, norms, and cultural experiences, while the responsive component ensures that teaching strategies, methods, and resources are aligned with students' learning needs. The use of interactive tools such as Wordwall and appealing learning materials has proven effective in helping students better visualize and comprehend the concept of exponents. These interactive features encourage active participation, allowing students to construct their own understanding of the material ultimately contributing to improved learning outcomes.

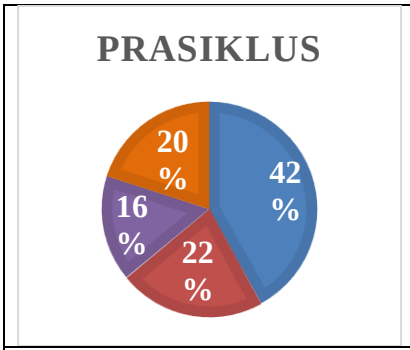

Figure 1. Student Test Results in Pre-cycle Activities

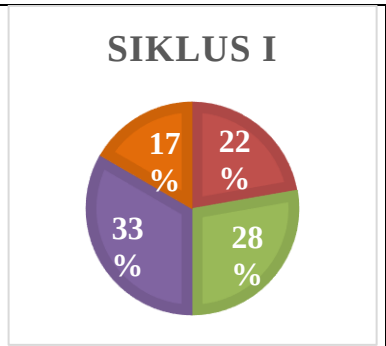

Figure 2. Student Test Results in Cycle I Activities

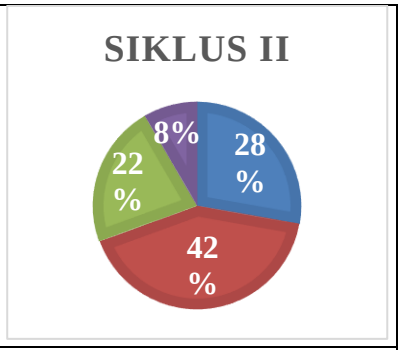

Figure 3. Student Test Results in Cycle I Activities

The information is categorized into five levels, each represented by a specific color. the "very good" level is indicated by light blue, symbolizing excellent performance or quality. The "good" level is marked with the color red, showing a positive but slightly lower status than "very good." The "moderate" or "sufficient" level is represented by yellow, indicating an average or acceptable condition. The "not enough" level is colored green, reflecting a condition that is below the desired standard. Finally, the "very less" level is shown in gray, representing the lowest category with significantly insufficient performance or quality.

The results of the analysis showed a progressive increase in the achievement of learning objectives from the pre-cycle to cycle II. At the pre-cycle stage, the proportion of students in the very good category was relatively low, while the Less and Sufficient categories were predominant. This indicates that the initial learning process was still less effective in meeting the expected objectives. In cycle I, a significant improvement was observed, with a decrease in the percentage of students in the Less category and an increase in those in the good category. This suggests that the learning strategy

began to positively impact student understanding. Cycle II yielded even more optimal results, dominated by the good and very good categories. The reduction in the Sufficient category and the absence of participants in the Less or Very Less categories further reinforce the success of the applied learning approach. This improvement confirms that the employed learning method has successfully increased the achievement of objectives in a sustainable manner.

Overall, the data illustrate consistent and significant development in learning achievement, indicating the success of the adaptation of teaching methods and the effectiveness of interventions conducted from the pre-cycle to cycle II. This provides a strong basis for maintaining and further developing similar methods in the future. Thus, there was a significant increase in student learning achievement after implementing the learning strategy improvements in cycle II, demonstrating the effectiveness of the CRT approach supported by Wordwall media in enhancing student learning outcomes.

The improvement in students' learning outcomes is the primary indicator of success in this study. Based on the analyzed data, the implementation of the CRT approach supported by Wordwall media has been proven to have a positive impact on the achievement of learning objectives. At the pre-cycle stage, students' learning outcomes showed a low average score, with a majority falling into the Less category and only a small portion reaching the Sufficient or higher categories.

Following the implementation of cycle I, there was a significant increase, with a growing proportion of students in the good category and a drastic reduction in those in the Less category. The average learning outcomes improved overall, indicating a positive response to the learning strategies applied.

In Cycle II, improvements became even more apparent, with dominance in the good and very good categories and no participants in the poor or very poor categories. These results reflect the effectiveness of the CRT approach supported by interactive Wordwall media in enhancing students' understanding and achievement of learning objectives, particularly in the exponent material. The consistent progress from the pre-cycle through cycle II demonstrates the success of this method in creating relevant, engaging, and meaningful learning experiences for students.

The improvement in learning outcomes observed from pre-cycle to cycle II indicates several key points: Interventions based on local culture facilitate students' ability to relate mathematical concepts to real-life contexts. The interactive Wordwall media creates a more engaging, competitive, and collaborative learning environment. The application of an adaptive and responsive approach to student characteristics has been shown to increase students' emotional and cognitive engagement in the learning process. This improvement extends beyond numerical scores; students' increased willingness to present, actively discuss, and correctly answer contextual questions previously difficult for them reflects growth in affective and metacognitive domains, not just cognitive skills.

This finding aligns with Gay (2018) research, which states that culturally responsive teaching can enhance student participation and learning outcomes, especially in culturally diverse groups. Additionally, Kaban et al. (2023) emphasized that Interactive digital learning media increases students' understanding of mathematical concepts and learning motivation. Thus, the integration of CRT and Wordwall within the local context has proven to be effective not only theoretically but also practically in real classroom settings. These results contribute to more inclusive and meaningful mathematics learning practices.

CONCLUSION

This study revealed that the application of the Culturally Responsive Teaching (CRT) approach, supported by interactive media such as Wordwall, has proven effective in improving student learning outcomes in exponent material. By making learning more relevant to the students' cultural backgrounds, this approach enhances their enthusiasm and engagement in the learning process. The results showed a significant increase in the achievement of learning objectives across the cycles. In the pre-cycle phase, most students had not met the learning objective completion criteria. However, after implementation in cycle I and further improvements in cycle ii, there was a substantial increase in student achievement. in cycle II, the percentage of students categorized as "very good" and "good" rose drastically, while those in the "poor" and "very poor" categories decreased significantly. The use of more interactive strategies, including Wordwall media, strengthened students' understanding of exponential material and increased their active participation. Thus, the Wordwall-assisted CRT approach not only enhances mathematical comprehension but also fosters a more inclusive and culturally responsive learning environment. The successful implementation of this strategy can serve as a model for developing more effective learning methods in the future, ultimately improving the overall quality of student learning outcomes.

REFERENCES

Afandi, A., Junanto, T., & Afriani, R. (2016). Implementasi digital-age literacy dalam pendidikan abad 21 di Indonesia. In Prosiding SNPS (Seminar Nasional Pendidikan Sains) (Vol. 3, pp. 113-120). https://core.ac.uk/download/pdf/289791953.pdf

Afrianti, N., Asdar, A., & Ismail, I. (2024). Peningkatan hasil belajar matematika melalui penerapan pendekatan culturally responsive teaching. *Global Journal Education Humanity*, 1(2), 172-176. https://jurnal.sainsglobal.com/index.php/gjeh/article/view/2138

Agusti, N. M., & Aslam, A. (2022). Efektivitas media pembelajaran aplikasi wordwall terhadap hasil belajar ipa siswa sekolah dasar. *Jurnal Basicedu*, 6(4), 5794-5800. https://doi.org/10.31004/basicedu.v6i4.3053

Akbar, H. F., & Hadi, M. S. (2023). Pengaruh penggunaan media pembelajaran wordwall terhadap minat dan hasil belajar siswa. *Community Development Journal: Jurnal Pengabdian Masyarakat*, 4(2), 1653-1660. https://repository.umj.ac.id/14011/1/13143-Article%20Text-40838-1-10-20230402.pdf

Alfaruqi, A. Z., & Nurwahidah, N. (2025). Reflection on indonesia's pisa scores and the 2024 madrasah teacher competency assessment results: challenges in enhancing teacher competence. *Jurnal Pendidikan IPS*, 15(1), 11-19. https://doi.org/10.37630/jpi.v15i1.2559

Arifah, A. N., Rahma, A. L., Savon, I. M., Mutiara, K., Sekarningrum, S. A., & Marini, A. (2023). Pembelajaran IPS sekolah dasar dengan aplikasi Wordwall untuk meningkatkan hasil belajar siswa. *Jurnal Pendidikan Dasar Dan Sosial Humaniora*, 3(1), 115-122. https://bajangjournal.com/index.php/JPDSH/article/view/6750

Arifin, A. H., Pratiwi, W. R., Andriyansah, A., & Sultan, Z. (2024). Peningkatan kreativitas guru PAUD di Kota Tangerang dalam membuat media pembelajaran berbasis canva. *Journal Of Human And Education (JAHE)*, 4(1), 151-157. https://doi.org/10.31004/jh.v4i1.571

Asmaliyah, F., Keriyani, N. M. I., & Nugroho, S. (2025). Meningkatkan motivasi dan hasil belajar peserta didik melalui penerapan model problem-based learning dengan pendekatan culturally responsive teaching dalam pembelajaran matematika. *Jurnal Ilmiah Profesi Pendidikan*, 10(1), 840-850. https://doi.org/10.29303/jipp.v10i1.3136

Astuti, H. Y. (2023). Evaluasi efektivitas pembelajaran berdiferensiasi materi matriks dengan memperhatikan kearifan lokal pertanian padi sebagai konteks belajar. *JSG: Jurnal Sang Guru*, 2(3). http://ejournal.uinib.ac.id/jurnal/index.php/jsg/article/view/7939

Beatty, A., Berkhout, E., Bima, L., Pradhan, M., & Suryadarma, D. (2021). Kemajuan pendidikan, pembalikan pembelajaran: Profil pembelajaran Indonesia antara tahun 2000 dan 2014. *Jurnal Internasional Pengembangan Pendidikan*, 85. https://doi.org/10.1016/j.ijedudev.2021.102436

Comstock, M., Litke, E., Hill, K. L., & Desimone, L. M. (2023). A culturally responsive disposition: How professional learning and teachers' beliefs about and self-efficacy for culturally responsive teaching relate to instruction. *AERA Open*, 9, 23328584221140092. https://doi.org/10.1177/23328584221140092

Damayanti, L., Hiltrimartin, C., & Wati, D. (2023). Cultural responsive teaching: increasing student PPKN learning outcomes. *Journal of Basic Education Research*, 4(3), 85-90.. https://doi.org/10.37251/jber.v4i3.723

Enjelina, R. F., Damayanti, R., & Dwiyanto, M. (2024). Penggunaan pendekatan Culturally Responsive Teaching (CRT) untuk meningkatkan hasil belajar matematika siswa kelas V SD. *Edutama: Jurnal Ilmiah Penelitian Tindakan Kelas*, 1(1), 39-51. https://doi.org/10.69533/t35nhb59

Fauzi, H., Yaniawati, R. P., & Sari, N. M. (2024). Penerapan pembelajaran computer-based learning dalam upaya meningkatkan kemampuan pemahaman matematika siswa. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, 3(2), 225-240. https://doi.org/10.31980/pme.v3i2.1671

Fahlevi, M. R. (2022). Upaya pengembangan number sense siswa melalui kurikulum merdeka (2022). *Sustainable Jurnal Kajian Mutu Pendidikan*, 5(1), 11-27. DOI: https://doi.org/10.32923/kjmp.v5i1.2414

Firdausy, I. A., Pratiwi, D. E., & Hastungkoro, H. N. A. (2024). Penerapan model project-based learning melalui pendekatan culturally responsive teaching untuk meningkatkan hasil belajar matematika kelas 1 di SDN Putat Jaya IV-380 Surabaya. *Journal of Science and Education Research*, 3(2), 37-42. https://doi.org/10.62759/jser.v3i2.127

Gay, G. (2018). Culturally responsive teaching: Theory, research, and practice. Teachers College Press.

Gumilar, G., & Rosid, D. P. S. (2024). Peranan supervisi dalam meningkatkan kualitas pembelajaran berkelanjutan. *Jurnal Ilmiah Pendidikan Citra Bakti*, 11(3), 651-661. https://doi.org/10.38048/jipcb.v11i3.3189

Gunawan, G., Lubis, A. R., Yusuf, K., & Yani, A. (2024). Pelatihan canva untuk guru-guru di SMA swasta Amir Hamzah Medan Sumatera Utara. *Jurnal Masyarakat Indonesia (Jumas)*, 3(01), 34-37. https://doi.org/10.54209/jumas.v3i01.74

Hansa, G. Z., & Muthi, I. (2024). Meningkatkan pemahaman konsep matematika siswa sekolah dasar dalam operasi bilangan bulat menggunakan media koin bermuatan. katalis pendidikan. *Jurnal Ilmu Pendidikan dan Matematika*, 1(3), 187-194. https://doi.org/10.62383/katalis.v1i3.587

Hidayaty, A., Qurbaniah, M., & Setiadi, A. (2022). The Influence of Wordwall on Students' Interests and Learning Outcomes. *Jurnal Penelitian Ilmu Pendidikan*. https://doi.org/10.21831/jpipfip.v15i2.51691.

Indrawan, R., & Yaniawati, R. P. (2016). Metodologi penelitian: Kuantitatif, kualitatif dan campuran untuk manajemen, pembangunan, dan pendidikan.

Jannah, M., & Hayati, M. (2024). Pentingnya kemampuan literasi matematika dalam pembelajaran matematika. *Griya Journal of Mathematics Education and Application*, 4(1), 40-54. https://doi.org/10.29303/griya.v4i1.416

Kaban, L., Puspa, M., Yoki, M., Sihombing, M., Pratiwi, W., Guru, P., Dasar, S., & Medan, U. (2023). Interactive Learning Through Digital Media: Enchancing Elementary Math Instruction. *Jurnal Arjuna : Publikasi Ilmu Pendidikan, Bahasa dan Matematika*. https://doi.org/10.61132/arjuna.v1i6.331.

Kerrigan, V., Lewis, N., Cass, A., Hefler, M., & Ralph, A. P. (2020). "How can I do more?" Cultural awareness training for hospital-based healthcare providers working with high Aboriginal caseload. *BMC Medical Education*, 20, 1-11. https://doi.org/10.1186/s12909- 020-02086-5

Khalisah, H., Firmansyah, R., Munandar, K., & Kuntoyono, K. (2024). Penerapan PJBL (Project-Based Learning) dengan pendekatan CRT (Culturally Responsive Teaching) untuk meningkatkan hasil belajar siswa pada materi bioteknologi kelas X-7 SMA Negeri 5 Jember. *Jurnal Biologi*, 1(4), 1-9. https://doi.org/10.47134/biology.v1i4.1986

Kristanto, Y. D. (2020). Upaya peningkatan kualitas pembelajaran matematika melalui flipped classroom dan gamifikasi: Suatu kajian pustaka. In PRISMA, Prosiding Seminar Nasional Matematika (Vol. 3, pp. 266-278). Jurusan Matematika FMIPA UNNES. https://repository.usd.ac.id/36900/1/5992_Kristanto_PRISMA_3_266-278.pdf

Kurniasih, S. R. (2021). Buku inovasi media belajar saat pandemi edisi 1. Cerita Guru Belajar & Media merdeka Belajar.

Kurniati, K., Kusumah, Y., Sabandar, J., & Herman, T. (2015). Kemampuan Berpikir Kritis Matematis Melalui Pendekatan Pembelajaran Kontekstual. *Jurnal Pendidikan Matematika*, 6, 53-62. https://doi.org/10.22342/jme.6.1.1901.53-62

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American educational research journal*, 32(3), 465-491. https://doi.org/10.3102/00028312032003465

Lestari, R., & Rohmani, R. (2024). Analysis of the Effectiveness of Wordwall Media Use on Science Learning Outcomes in Elementary Schools. *IJORER : International Journal of Recent Educational Research*. https://doi.org/10.46245/ijorer.v5i4.634.

Luluk, L. (2024). Eskalasi kualitas pembelajaran melalui penelitian tindakan kelas. *Ta'limDiniyah: Jurnal Pendidikan Agama Islam (Journal of Islamic Education Studies)*, 4(2), 276-287. https://doi.org/10.53515/tdjpai.v4i2.119

Martini, R. S., Gunarti, W., Satrio, M. G., Maryam, M., AS, H. K., & Zahra, C. A. (2023). Pelatihan penggunaan aplikasi canva for education, bagi Guru Paud di Kecamatan Pulo Gadung. *Jurnal Basicedu*, 7(5), 3242-3248. https://doi.org/10.31004/basicedu.v7i5.6067

Markey, K., Brien, B., Kouta, C., Okantey, C., & Donnell, C. (2021). Embracing classroom cultural diversity: Innovations for nurturing inclusive intercultural learning and culturally responsive teaching. *Teaching and Learning in Nursing*. https://doi.org/10.1016/J.TELN.2021.01.008.

Mujahidin, A. A., Salsabila, U. H., Hasanah, A. L., Andani, M., & Aprillia, W. (2021). Pemanfaatan media pembelajaran daring (quizizz, sway, dan wordwall) kelas 5 di SD Muhammadiyah 2 Wonopeti. *Innovative: Journal Of Social Science Research*, 1(2), 552–560. Retrieved from https://j-innovative.org/index.php/Innovative/article/view/113

Molita, A., Widiyanto, R., Ariyanti, G., & Dian, M. (2024). Penerapan strategi pendekatan Culturally Responsive Teaching (CRT) dalam pembelajaran berdiferensiasi untuk meningkatkan hasil belajar

matematika peserta didik kelas XII-5 SMAN 6 Surabaya. *Journal of Comprehensive Science (JCS)*, 3(10). Doi : http://doi.org/10.59188/jcs.v3i10.2086

Mursalin, M., Ali, M., & Armita, D. (2024). Pelatihan Canva sebagai Upaya Peningkatan Kompetensi Digital Bagi Guru SMA dalam Implementasi Kurikulum Merdeka. *Jurnal Solusi Masyarakat Dikara*, *4*(1), 38-44. https://doi.org/10.5281/zenodo.12337816

Mutiaratri, R. L., Wijayanti, T. S., & Merta, I. W. (2024). Peningkatan kemampuan kognitif peserta didik pada mata pelajaran biologi menggunakan pendekatan culturally responsive teaching (CRT) di kelas XB SMA 1 Labuapi tahun ajaran 2023/2024. *Jurnal Ilmiah Profesi Pendidikan*, *9*(1), 199-204. https://doi.org/10.29303/jipp.v9i1.1821

Mulyati, S., & Evendi, H. (2020). Pembelajaran matematika melalui media game quizizz untuk meningkatkan hasil belajar matematika SMP 2 Bojonegara. *Jurnal Pendidikan Matematika*, 3(01), 64-73. https://doi.org/10.30656/gauss.v3i1.2127

Nuraridha, S., Rahmat, I., & Rahayu, S. (2024). Peran guru dalam penerapan pembelajaran abad 21 untuk peningkatan kompetensi matematika siswa. *Jurnal Ilmu Pendidikan*, 18(2), 76-89.

Nurfadhillah, S., Ningsih, D. A., Ramadhania, P. R., & Sifa, U. N. (2021). Peranan media pembelajaran dalam meningkatkan minat belajar siswa SD Negeri Kohod III. Pensa, 3(2), 243-255. https://doi.org/10.36088/pensa.v3i2.1338

OECD. (2023b). PISA 2022 Results (Volume I): The State of Learning and Equity in Education. OECD. https://doi.org/10.1787/53f23881-en

Permana, S. P., & Kasriman, K. (2022). Pengaruh media pembelajaran Wordwall terhadap motivasi belajar IPS kelas IV. *Jurnal Basicedu*, 6(5), 7831-7839. https://doi.org/10.31004/basicedu.v6i5.3616

Pinahayu, E. A. R. (2016). Problematika pembelajaran matematika pada pokok bahasan eksponen dan alternatif pemecahannya. Formatif: *Jurnal Ilmiah Pendidikan MIPA*, 5 (3), 182–191. https://journal.lppmunindra.ac.id/index.php/Formatif/article/view/642

Pinta, A. R., Karim, H. A., & Trisna, L. (2024). Implementasi penggunaan media wordwall pada mata pelajaran PAI untuk meningkatkan motivasi dan minat belajar siswa di SMPN 3 kecamatan Guguak. *Ta'rim: Jurnal Pendidikan dan Anak Usia Dini*, 5(1), 126-134. https://doi.org/10.59059/tarim.v5i1.983

Partasiwi, N., Safitri, D., & Syaadah, R. S. (2023). Pelatihan pembuatan media pembelajaran berbasis canva untuk guru-guru sekolah menengah pertama di kota Bekasi. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, 2(2), 152-156. https://doi.org/10.31004/jerkin.v2i2.225

Pramesti, F. I. (2025). Lesson study: Upaya meningkatkan kualitas pembelajaran matematika. *Jurnal Edukasi dan Sains Matematika (JES-MAT)*, 11(1), 51-62. http://journal.uniku.ac.id/index.php/JESMath/article/view/11693

Pratiwi, R., Amilia, W., & Masnur, A. (2023). Pelatihan pembuatan media pembelajaran dengan Canva bagi guru SMAN 1 X Koto Kabupaten Tanah Datar. *Jurnal Pendidikan Tambusai*, 7(3), 25831-25838. https://jptam.org/index.php/jptam/article/download/10752/8572/19973

Prihantoro, A., & Hidayat, F. (2019). Melakukan penelitian tindakan kelas. *Ulumuddin: jurnal ilmu-ilmu keislaman*, 9(1), 49-60. https://doi.org/10.47200/ulumuddin.v9i1.283

Purnamasari, S., Rahmanita, F., Soffiatun, S., Kurniawan, W., & Afriliani, F. (2022). Bermain bersama pengetahuan peserta didik melalui media pembelajaran berbasis game online word wall. *Jurnal Pengabdian Masyarakat*, 3(1), 70-77. https://doi.org/10.32493/al-jpkm.v3i1.17052

Putri, L. I. D. (2024). Implementasi pendekatan culturally responsive teaching guna meningkatkan hasil belajar matematika kelas v materi penyajian data. *Edutama: Jurnal Ilmiah Penelitian Tindakan Kelas*, 1(1), 221-231. https://doi.org/10.69533/487tam71

Rahmawati, Y., Rahman, A., Ridwan, A., Triwana, M., Handayani, T., Fahriza, N., ... & Rizqiya, L. (2017). Pendekatan pembelajaran kimia berbasis budaya dan karakter: Culturally responsive teaching terintegrasi etnokimia. *Journal of Chemical Information and Modeling*, 53(9), 287. https://opac.fitk.uinjkt.ac.id/index.php?p=show_detail&id=25594

Rika, R., Rachmadani, J., Nuran, A. A., Ariatna, A., & Arnita, A. (2024). Pendampingan dan pelatihan media ajar interaktif wordwall berbasis literasi numerasi di sdn 105290 desa kolam, kec. Percut sei tuan, kab. Deli serdang. *Jurnal Pengabdian Mandiri*, 3(9), 833–842. Retrieved from https://bajangjournal.com/index.php/JPM/article/view/8650

Rohman, A. D., & Khaliza, T. N. (2024). Inovasi media pembelajaran wordwall berbasis quizizz: alternatif dalam meningkatkan critical thingking siswa di era abad 21. *Jurnal Masyarakat Berdikari dan Berkarya (Mardika)*, 2(2), 72-79. DOI: https://doi.org/10.55377/mardika.v2i2.10159

Rosdiani, L., Munawar, B., & Dewi, R. (2021). Pelatihan membuat game edukasi wordwall untuk guru di kelurahan karaton. *Jurnal Abdimas Bina Bangsa*, 2(2), 247-255. https://doi.org/10.46306/jabb.v2i2.138

Sari, A., Sari, Y. A., & Namira, D. (2023). Penerapan model pembelajaran problem based learning terintegrasi culturally responsive teaching (crt) untuk meningkatkan motivasi dan hasil belajar siswa kelas x ipa 2 sma negeri 7 mataram pada mata pelajaran kimia tahun ajaran 2022/2023. *Jurnal Asimilasi Pendidikan*, 1(2), 110-118. https://doi.org/10.61924/jasmin.v1i2.18

Sari, Y., Ansya, Y. A. U., Alfianita, A., & Putri, P. A. (2023). Studi literatur: Upaya dan strategi meningkatkan motivasi belajar siswa kelas V sekolah dasar dalam pembelajaran bahasa dan sastra Indonesia. *JGK (Jurnal Guru Kita)*, 8(1), 9-26. https://doi.org/10.24114/jgk.v8i1.53931

Suwarni, S., Poncowati, S., Supriatna, E., Adiputra, D., & Pasongli, H. (2024). Provide Instructors with A Learning Experience That is Fun, Convenient, and Enjoyable For Students. *EDUKASIA: Jurnal Pendidikan dan Pembelajaran*. https://doi.org/10.62775/edukasia.v5i1.719.

Shiddiq, J. (2021). Inovasi pemanfaatan word-wall sebagai media game-based learning untuk bahasa arab. *JALIE; Journal of Applied Linguistics and Islamic Education*, 5(1), 151-169. https://doi.org/10.33754/jalie.v5i1.337

Silitonga, I. D. B., & Siahaan, R. D. R. (2024). Pelatihan pembuatan media pembelajaran dengan aplikasi canva bagi guruguru smp putri cahaya medan. *Jurnal Pengabdian Masyarakat*, 1(3), 23–27. http://jurnalistiqomah.org/index.php/jpmi/article/view/873%0Ahttp://jurnalistiqomah.org/index.php/jpmi/ article/view/873/747

Siwatu, K. O. (2011). Preservice teachers' culturally responsive teaching self-efficacy-forming experiences: A mixed methods study. *The Journal of Educational Research*, 104(5), 360-369. https://doi.org/10.1080/00220671.2010.487081.

Sulistianingrum, E., Fauziati, E., Rohmah, W., & Muhibbin, A. (2023). Differentiated Learning : The Implementation of Student Sensory Learning Styles in Creating Differentiated Content. *Jurnal Paedagogy*. https://doi.org/10.33394/jp.v10i2.7030.

Susanto, E., & Sari, M. (2023). Effectiveness of Using The Wordwall Application on Student Learning Outcomes. *At-Ta'lim : Media Informasi Pendidikan Islam*. https://doi.org/10.29300/attalim.v22i1.11206.

Susilowati, D. (2018). Penelitian tindakan kelas (ptk) solusi alternatif problematika pembelajaran. *Jurnal ilmiah edunomika*, 2(01). DOI: https://doi.org/10.29040/jie.v2i01.175

Tangkoro, M., Monoarfa, J., & Maukar, M. G. (2024). Analisis kesulitan siswa dalam menyelesaikan soal eksponen. *Gammath : Jurnal Ilmiah Program Studi Pendidikan Matematika*, 9(1), 48–61. Retrieved from http://ejurnal.unmuhjember.ac.id/index.php/JPM/article/view/1731

Tasya, M. A., Maki, M., & Hadi, E. (2025). Pengaruh penerapan quiz wordwall terhadap peningkatan literasi membaca bahasa indonesia siswa kelas iv. *Jurnal Pendidikan, Sains, Geologi, Dan Geofisika (GeoScienceEdJournal)*, 6(2), 789-794. https://doi.org/10.29303/goescienceed.v6i2.727

Tsai, J., Lindo, E., & Bridges, K. (2021). Seeing the Window, Finding the Spider: Applying Critical Race Theory to Medical Education to Make Up Where Biomedical Models and Social Determinants of Health Curricula Fall Short. *Frontiers in Public Health*, 9. https://doi.org/10.3389/fpubh.2021.653643.

Tul'adawiyah, R., Nurihsan, J., & Budiman, N. (2024). A Systematic Literature Review on Student Boredom: Analyzing Contributing Factors. *Proceedings of the 5th International Conference on Psychological Studies, ICPSYCHE 2024, 24 – 25 July 2024, Semarang, Central Java, Indonesia*. https://doi.org/10.4108/eai.24-7-2024.2354297.

Utomo, P., Asvio, N., & Prayogi, F. (2024). Metode penelitian tindakan kelas (PTK): Panduan praktis untuk guru dan mahasiswa di institusi pendidikan. Pubmedia Jurnal Penelitian Tindakan Kelas Indonesia, 1(4), 19-19. https://doi.org/10.47134/ptk.v1i4.821

Virliana, A. I. (2024). Pengaruh evaluasi pembelajaran berbasis quizziz dan wordwall dalam meningkatkan pemahaman siswa. Nusantara, 6(1), 1-8. https://doi.org/10.36088/nusantara.v6i1.4272

Wahira, W., Hasan, H., & Hamid, A. (2024). Pelatihan Pelaksanaan Pendekatan Teaching At The Right Level Pada Guru Sekolah Dasar. *Jurnal Pengabdian Masyarakat Akademisi*, *2*(2), 01-07. https://doi.org/10.59024/jpma.v2i2.697

Wardana, J. W., & Ariyanto, L. (2024). Efektivitas pendekatan culturally responsive teaching berbantuan¬ e-lkpd dalam meningkatkan hasil belajar matematika siswa smp. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(2), 4955-4965. DOI: https://doi.org/10.23969/jp.v9i2.14349

Widianto, E. (2021). Pemanfaatan media pembelajaran berbasis teknologi informasi. *Journal of Education and Teaching*, 2(2), 213-224. https://doi.org//10.24014/jete.v2i2.11707