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THE EFFECT OF WORDWALL MEDIA ON PUPILS ACHIEVEMENT IN MATHEMATICS AMONG BASIC THREE PUPILS

Jamiu Temitope Sulaimon

Department of Adult and Primary Education, University of Ilorin, Ilorin, Kwara State, Nigeria * Correspondence: <u>sulaimonjamiu7991@gmail.com</u>

Abstract

Visual materials provide powerful pathways to increase the concrete learning experiences of children. This research examined how wordwall media affected Basic Three pupils' mathematics achievement within Kwara State Nigeria. This research adopted the one-group pre-test and post-test method from pre-experimental studies as its research design. One research question together with two hypotheses directed the study. The survey included 42 pupils as a single intact random selection. The WordWall Media Instructional Guide (WWMIG) and Mathematics Achievement Test (MAT) were used to gather data while PPMC determined their reliability coefficient at 0.75. The research data received descriptive statistical analysis and Analysis of Covariance (ANCOVA) served to test the hypotheses at a 0.05 significance level. The research discovered that scores from the pre-test at 41.51 altered to 50.48 on the post-test which produced an 8.97 points difference between the two periods. The implementation of wordwall media produced a significant positive effect on pupil mathematics achievement. The assessment of mathematics achievement found that wordwall media did not trigger a significant outcome involving gender as well as learning results. The researcher suggested that stakeholders along with the government must offer training to teachers for successful implementation of word wall media within classrooms. The training of teachers must include capabilities to create and implement gender-nonbiased word wall media effectively.

Keywords: basic school; mathematics; pupils; word wall media

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Introduction

All aspects of human living need mathematics at different points of educational progress. Mathematics which scientists describe as the science of magnitude and numbers functions as a fundamental research base for essentially every academic discipline according to published studies. Mathematics serves as foundational building blocks that help evaluate problems in addition to predicting study outcomes (Enu et al., 2015). Ayebale et al. (2020) observed that proficiency in mathematics matters both at an individual level and national level because it enables effective solutions for daily transactions and scientific growth and decision-making in various situations. Many schools throughout sub-Saharan Africa operate with statistics as part of their mathematics curriculum according to observations in Benin and also Nigeria as well as Kenya and Lesotho (Kele, 2018). Mathematics achievements of students throughout secondary schools in this particular region prove inadequate in comparison to desired results.

Learning attitudes together with perceptions and academic expectations about mathematics and teaching heavily affect how students experience and achieve academic success. Numerous students follow procedural methods to study mathematics by focusing on rules rather than understanding wider applications. The subject understanding of students is impaired by their restricted focus on rules and procedures which impedes their competency growth (Ayebale et al., 2020). Research on mathematics performance factors has generated various outcomes into multiple studies conducted by scholars. While some research points to a strong link between attitudes towards mathematics and academic success (Tus, 2020; Mullis et al., 2020; Longobardi et al., 2021), others view these attitudes as simply a preference or dislike for the subject. Student attitudes combine with teacher attitudes plus teaching approaches and classroom environment as essential performance determining elements (Valantinaitė & Sederevičiūtė-Pačiauskienė, 2020; Getie, 2020; Assem et al., 2023).

Student performance in mathematics heavily depends on their attitudes towards the subject. Studies have identified a direct relationship between students' psychological positioning about subjects and their educational achievements. The research by Mazana et al. (2019) has established that elementary school students show a direct relationship between their mathematical emotions and their assessment results. Student achievement in mathematics heavily depends on how teachers express their attitudes toward the subject. Denessen et al. (2022) shows that students develop similar attitudes as their teachers therefore affecting their academic achievement. Positive teacher attitudes across all observations have proven to consistently increase students' achievement results. Teacher-held beliefs concerning mathematics utility and their perception of learning difficulty as well as their gender-based stereotypes directly influence their teaching attitude towards mathematics which ultimately affects student achievement (Linder et al., 2022).

Students need suitable teaching approaches to grasp fundamental mathematical principles effectively. The teaching field contains various educational methods as well as instructional techniques that teachers implement to transmit learning material or specific abilities (Fukuda et al., 2024). The implementation of inclusive teaching methods provides balanced learning chances to all students. Arifiati et al. (2020) further emphasized that students demonstrate reduced academic performance if the teaching techniques fail to help them understand the material.

The performance of children in mathematics develops under the strong influence of parental involvement. Through example leadership and educational interventions parents encourage their children to pursue high academic outcomes while appreciating the value of learning (Sengönül et al., 2022). Kiwanuka et al. (2015) findings into how people enrolled in first grade of secondary school education in Central Uganda demonstrated better mathematics results based on their parent involvement. The performance levels of students in mathematics are determined by their past math success and adolescent age as well as gender-related stereotypes and educational settings (Ayebale et al., 2020). The implementation of modern creative teaching methods requires better mathematics comprehension in elementary school students. Most students find difficulties with math education and teachers need to create engaging learning materials to improve engagement. A complete mastery of mathematics leads students to academic achievement alongside improved skills for critical thinking and problem solving (Theobald et al., 2020). Teachers need to put their main focus on creating both effective and interesting instructional methods that apply to elementary education. Teachers must utilize proper instructional approaches which demonstrate mathematics beauty and usefulness together with the development of higher-order thinking abilities. Educational assignments that challenge student intelligence help develop mathematics-friendly attitudes in students (Singh et al., 2023). Students' response patterns to particular assignments depend greatly on the instructional presentation methods. Active learning methods that involve students solving authentic practical issues improve their critical reasoning capabilities and their capability to make effective decisions according to Dzaiy and Abdullah (2024). The design of specific tasks in these educational settings uses culturally and socially important elements to create more impactful and engaging math learning experiences.

Direct involvement and manipulation through hands-on activities make an effective teaching method for mathematics (Oladele, 2024). Activity-based strategies build knowledge through "learning by doing" principles. The practice of hands-on math teaching involves manipulative tools as a popular visual tool to advance student learning of mathematical concepts. Teachers should utilize different tangible learning tools which combine manipulation elements with reflection techniques and discussion methods to create a "minds-on" educational environment. Students utilize structured materials to everyday household items in order to create models and complete hands-on (Monte, 2021). Kenderov et al. (2009) reported that numerous students lack meaningful interaction with mathematics so they end up developing unfavorable opinions about the subject. Outdoor learning represents their idea as an essential supplementary educational approach to formal classroom learning. Math trails represent a distinctive outdoor strategy that develops intended mathematical challenges at separate points on paths for students to solve (Vale & Barbosa, 2018). In his study Rosado and Ribeiro (2024) demonstrated why asking stimulating questions serves as a key approach to excite students about environmental exploration for meaningful problem-solving. Math trails present participants with real-life mathematical challenges which require them to use acquired knowledge through problem-solving work that boosts their abilities for communication and critical thinking and problem-solving. These educational activities establish an interactive classroom setting where students find discovery opportunities to build stronger mathematical understanding (Oladele, 2024).

The implementation of active learning techniques such as math trails faces challenges from institutional restrictions and standardized testing obstacles as stated in Theobald et al. (2020). Fukuda et al. (2024) argued that numerous active learning approaches successfully deliver instruction to elementary students while innovative teaching methods would enhance their mathematical performance. WordWall media serves as a proven educational tool for mathematics instruction in elementary school settings according to Pamungkas et al. (2023). The Wall Word converts classrooms into animated learning spaces that help teachers display numerical material through images combined with words. Using WordWall media enhances student motivation to learn math because it creates interactive lessons which keep students interested in understanding concepts. WordWall presents itself as an educational platform which offers interactive learning resources while providing assessment features (Al-Qonita et al., 2022); Noor et al. (2023); Launin et al., 2022). Through WordWall teachers develop learning environments that combine effective instruction approaches with high-quality content teaching methods (Triyani et al., 2024). Educational professionals can access numerous templates to create games which they can distribute through WhatsApp links and Google Classroom in addition to email connections. The PDF printing option within the application grants students who face reduced internet availability a valuable solution (Rinov et al., 2023). The classroom implementation of WordWall produces an interactive and engaging learning space which improves student mathematics experiences. The figure below shows how WordWall looks and functions (Figure 1).

Figure 1 demonstrates the functionality of Wordwall that enables learners to interact with Match Up, Quiz and Random Wheel features through drag and drop and timed questions and wheel-based displays. The program includes two activities: Missing Word creates blanks for users to place correct responses while Group Sort demands sorting of items into specified categories. The Matching Pairs activity requires learners to match answers with their corresponding questions or images and Unjumble tasks them to correctly arrange words and sentences (Salsabila & Tsurayya, 2024).

Learning effectiveness gets improved through the numerous interactive components of Wordwall. Learning experiences in Wordwall include Random Cards which picks answers from shuffled decks and Find the Match that requires players to select correct answers while Open the Box lets students make choices from revealed boxes (Salsabila & Tsurayya, 2024). The platform provides three interactive activities through Wordwall including Anagram for word reformation and Labeled Diagram for subject identification followed by Gameshow Quiz for timed questions. Games like Whac-a-mole and True or False together with Balloon Pop, Maze Chase and Airplane represent a collection of visually interesting games that let learners interact with mathematical content (Salsabila & Tsurayya, 2024). The designed features improve student comprehension alongside promotion of long-term information retention thus creating a more active and productive learning environment in elementary schools.

Current research confirms Wordwall enables better mathematical understanding among elementary school students. For example Azizah (2023) found that visual-spatial abilities demonstrated exceptional improvement through Wordwall particularly when it came to geometry instruction. Similarly, Asmadi (2022) highlighted how Wordwall functions as a platform which helps students develop better critical thinking abilities alongside enhanced mathematical understanding. Research conducted by Akbar (2023) demonstrated how Wordwall increases math motivation and student interest and Sarwendah (2023) established that the tool enhances learning activity collaboration among students. Through a prolonged investigation Nafia (2021) verified the effectiveness of Wordwall as an instrument for fostering ongoing development in mathematical comprehension thus demonstrating the extensive benefits of this platform for elementary education. The research outcomes match those obtained by Nurhayati & Gunawan (2022) who validated that mathematical representation skills enhance through the use of Desmos graphing calculators. The research presented by Lubis and Nuriadin (2022) showed Wordwall serves as a positive influence on educational success through its ability to help students maintain classroom material better and enhance their interest in mathematics. Students achieve higher concept retrieval rates together with improved learning motivation when Rachmawati et al. (2020) integrate generative learning models with Wordwall media.

The research by Elhefni et al. (2023) established that Wordwall learning media led to substantial changes in students' achievement results throughout Indonesian language education. Darma et al. (2023) studied word mastery outcomes among SMPN seventh-grade students using Wordwall platform and confirmed better vocabulary results among students who utilized Wordwall rather than their counterparts who received no Wordwall instruction. The study by Muflikhah and Kamal (2024) evaluated how Wordwall functions as a mathematics evaluation instrument in Madrasah Ibtidaiyah. Their findings indicated that students showed a high level of enthusiasm for using Wordwall for assessments, with an enthusiasm rate of 81.4%. Furthermore, Wordwall proved to be effective for mathematics assessment, achieving an N-gain value of 0.33, which is categorized as medium, and a hypothesis test value of 0.000 < 0.05, indicating a significant difference between pretest and posttest results.





Research by Fernando et al. (2024) confirmed these findings by studying enhancement of students' mathematical problem-solving abilities using Wordwall-assisted problem-based learning. The researchers obtained positive results demonstrating improved problem-solving abilities between pretests and posttests specifically in the experimental group of grade III elementary students. Sitepu and Pulungan (2024) investigated the impact Wordwall media delivers to arithmetic operations when used in classrooms. Students in the fifth grade demonstrated significant improvements on their multiplication tests after using Wordwall according to the research results. The potential of WordWall to improve mathematics learning among elementary students stands established through existing research while its application in Kwara State, Nigeria requires additional investigation. The absence of local studies about this subject leaves researchers and teachers uncertain about WordWall's complete influence on elementary mathematics teaching. This research strives to fulfill the identified gap in knowledge by studying what effect WordWall media has on Basic Three students' mathematical achievement in Kwara State. Research Question: What is the difference in the pretest and posttest achievement in mathematics. Research Hypothesis: (1) There is no statistical significant main effect of word wall on pupils achievement in mathematics; (2) There is no statistical significant interaction effect of word wall and gender on pupils achievement in mathematics.

Methods

The study employed a pre-experimental research design, specifically a one-group pre-test and post-test method. This approach was selected to assess the impact of WordWall media on students' mathematics performance within a single class. The chosen class first took a pre- test, then received instruction using WordWall media during the teaching process, and finally completed a post-test.

Research Framework

Basic three class (Pretest) Class teaching with treatment (word wall media) Basic three class (Posttest) *Variables* Independent Variables (word wall media) Dependents Variables (Pupils Achievement in Mathematics)

Moderating Variable (Gender)

The study involved all Basic Three pupils in Ifelodun Local Government Area, from which a single class of 47 pupils was randomly chosen as the sample. Two tools were used for data collection: the Word Wall Media Instructional Guide (WWMIG) and the Mathematics Achievement Test (MAT). The questions for the MAT were based on the scheme of work and the recommended textbooks for the class. The study instruments underwent assessment by two member lecturers from the education department at University of Ilorin accompanied by one mathematics teacher. Ten new pupils who were not included in the initial sample received the MAT twice with a delay of two weeks between tests in order to determine test reliability. The researchers applied Pearson Product Moment Correlation analysis to obtain a reliability coefficient of 0.75 for the collected data. The evaluation was carried out with SPSS while inferential statistics through Analysis of Covariance (ANCOVA) at a 0.05 significance level tested the research hypotheses.

Results

One research questions was generated, and was answered with the use of mean. The results were presented in the table below

Research Question: What is the difference in the pretest and posttest achievement in mathematics?

Achievement in M	athematics
Class	Mean
Pretest	41.51
Post test	50.48

Table 1. Mean Value of the Difference in the Pretest and Posttest

 Achievement in Mathematics

Table 1 demonstrates the mathematics achievement mean scores of pupils collected before utilizing word wall media. The pupil's mathematics achievement showed a mean value of 41.51 according to the table while the same table presented the post-word wall media achievement mean (50.48). The data shows that pupil mathematics achievement reached 50.48 points after they utilized word wall media. The posttest mean value of 50.48 measured above the pretest mean of 41.51 by 8.97 indicating that word wall media has had a positive impact. **Research Hypothesis One:** *There is no statistical significant main effect of word wall on pupils achievement in mathematics*

 Table 2. Summary of ANCOVA on statistical significant main effect of word wall on pupils achievement in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Remark
Corrected Model	1683.048 ^a	1	1683.048	6.054	.016	
Intercept	177744.000	1	177744.0	639.340	.000	
Group	1683.048	1	1683.048	6.054	.016	Significant
Error	22796.952	82	278.012			
Total	202224.000	84				
Corrected Total	24480.000	83				

a. R Squared = .069 (Adjusted R Squared = .057)

Table 2 summarizes the ANCOVA results, showing a significant main effect of Word Wall on students' performance in mathematics. The F-value of 6.054 is significant at 0.05 level. As a result, the null hypothesis which claims that there is no significant main effect of Word Wall on students' mathematics achievement was rejected, since the p-value (p = .016) is below 0.05. This suggests a meaningful impact of WordWall on students' mathematics achievement.

Research Hypothesis Two: There is no statistical significant interaction effect of word wall and gender on pupil's achievement in mathematics

gender on pupil's achievement in mathematics							
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Remark	
Corrected Model	2184.607 ^a	3	728.202	2.613	.057		
Intercept	168259.664	1	168259.7	603.747	.000	Not	
Group	1799.895	1	1799.895	6.458	.013	Significa	
Gender	373.998	1	373.998	1.342	.250	nt	
Group * Gender	127.562	1	127.562	.458	.501		
Error	22295.393	80	278.692				
Total	202224.000	84					
Corrected Total	24480.000	83					

Table 2: Summary of ANCOVA on statistical significant interaction effect of word wall and gender on pupil's achievement in mathematics

a. R Squared = .089 (Adjusted R Squared = .055)

Table 3 shows summary of ANCOVA on statistical significant interaction effect of word wall and gender on pupils achievement in mathematics. The F score of .458 does not reach statistical significance during a .05 significant level assessment. The research retained its initial hypothesis which predicted no statistical significance between word wall media use and gender when measuring mathematics learning outcomes because the p-value (p= .501 >0.05) exceeded the significant threshold.

Discussion

The study explored how Word Wall media impacts the mathematics achievement of Basic Three pupils in Ifelodun Local Government Area, Kwara State, Nigeria. Table 1 shows the average scores of pupils' mathematics achievement before and after the introduction of Word Wall media. The pre-test average score was 41.51, while the post-test average score increased to 50.48, indicating a difference of 8.97 points. This improvement suggests that Word Wall media had a positive effect on the pupils' mathematics achievement. These results are consistent with previous research. For example, Fernando et al. (2024) found a significant positive change in pre-test and post-test mathematics problem-solving skills, which they attributed to the use of Word Wall-assisted problem-solving learning among Grade Three pupils. Likewise, Muflikhah and Kamal (2024) observed a notable enhancement in mathematics performance when Word Wall media was used to teach Madrasah Ibtidayah learners. Additionally, Sakkir et al. (2023) determined that the digital Word Wall game significantly improved students' vocabulary skills, as shown by the mean difference between pre-test and post-test scores. Together, these studies reinforce the effectiveness of Word Wall media as a teaching resource.

A 6.054 F-value achieved statistical significance at a 0.05 level according to the study which was shown in Table 2. Research data supported the rejection of the null hypothesis that claimed no significant main effect between Word Wall media and student mathematics achievement because the calculated p-value (p = .016) was less than 0.05. The results prove that Word Wall media positively impact students' mathematics achievement levels statistically. The effectiveness of Word Wall media demonstrates better results in helping students develop their visual abilities as well as master mathematical terminology.

The research by Sitepu and Pulungan (2024) proved Word Wall media helped fifthgrade students improve both multiplication operations and counting techniques in mathematics effectively. Sawitri et al. (2019) established that seventh-grade students demonstrated writing achievements which were directly related to Word Wall media usage through statistical analysis. The positive effects of Word Wall learning media on Indonesian foundation school results match Elhefni et al. (2023) published findings. The research findings of Darma et al. (2023) proved that Word Wall media boosted seventh-grade students' academic results in classroom instruction sessions. The combination of studies validates Word Wall media as an effective tool to enhance learning results in multiple educational environments. Research results indicate that the F-value (0.458) fails to reach statistical significance for a 0.05 level test. The research findings support the null hypothesis that Word Wall media and gender do not produce a statistically significant effect on mathematics achievement because the reported p-value (p = 0.501) exceeds 0.05. The visual appeal of Word Wall media leads to equal academic achievement growth among male and female students during instructional moments. Results from Sulyman and Babalola (2023) demonstrate similar outcomes to their research on how classroom wall designs affect pupil significantly improved students' vocabulary skills, as shown by the mean difference between pre-test and post-test scores. Together, these studies reinforce the effectiveness of Word Wall media as a teaching resource achievement because students from both genders performed similarly when exposed to these designs. The study by Suryana (2017) produced different results regarding Word Wall teaching media effectiveness and gender influence on student achievement. Suryana reported that Word Wall media enhanced learning outcomes however male students improved more substantially than their female counterparts did.

Conclusion

Research results demonstrate that Word Wall media led to substantial enhancement of Basic Three pupils' mathematical success within Ifelodun Local Government Area of Kwara State Nigeria. The data show that Word Wall media produces equal effectiveness for both male and female pupils when it comes to their achievement in mathematics. The research findings led to the following recommendations.

- 1. Government and stakeholders should provide training and materials for teacher to enable easy adoption of word wall media in classes
- 2. Teachers training should be done to enable them design and utilize word wall media that are appealing to both gender.

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Conflicts of Interest

The authors affirm that there are no conflicts of interest related to the publication of this manuscript. Furthermore, ethical issues such as plagiarism, misconduct, data fabrication or falsification, duplicate publication or submission, and redundancies have been addressed and resolved by the authors.

References

- Akbar, H. F. (2023). Pengaruh penggunaan media pembelajaran wordwall terhadap minat dan hasil belajar siswa. *Jurnal Psikologi*, *4*, 1653–1660. <u>https://doi.org/10.31004/cdj.v4i2.13143</u>
- Al-qonita, A. S., Aliputri, N. U., & Kinasih, P. P. (2023, January). Literature Review: Efektivitas Aplikasi Wordwall Pada Pembelajaran Matematika Terhadap Kemampuan Berpikir Kritis Siswa. In *Prosandika Unikal (Prosiding Seminar Nasional Pendidikan*)

Matematika Universitas Pekalongan) (Vol. 4, No. 1, pp. 155-162). https://proceeding.unikal.ac.id/index.php/sandika/article/view/1184/764

- Arifiati, N., Nurkhayati, E., Nurdiawati, E., Pamungkas, G., Adha, S., Purwanto, A., ... & Azizi,
 E. (2020). University students online learning system during Covid-19 pandemic: Advantages, constraints and solutions. *Systematic reviews in pharmacy*, 11(7). http://dx.doi.org/10.31838/srp.2020.7.81
- Asmadi. (2022). Pemanfaatan game edukasi wordwall untuk meningkatkan proses belajar online. *Jurnal Didaktika Pendidikan Dasar*, 6(3), 945–962. <u>https://doi.org/10.26811/didaktika.v6i3.1048</u>
- Assem, H. D., Nartey, L., Appiah, E., & Aidoo, J. K. (2023). A review of students' academic performance in physics: Attitude, instructional methods, misconceptions and teachers qualification. *European Journal of Education and Pedagogy*, 4(1), 84-92. https://doi.org/10.24018/ejedu.2023.4.1.551
- Ayebale, L., Habaasa, G., & Tweheyo, S. (2020). Factors affecting students' achievement in mathematics in secondary schools in developing countries: A rapid systematic review. *Statistical Journal of the IAOS*, 36(S1), 73-76. <u>https://doi.org/10.3233/SJI-200713</u>
- Azizah, T. N. A. (2023). Penerapan media pembelajaran wordwall dalam menunjang pemahaman konsep siswa. JIIP - Jurnal Ilmiah Ilmu Pendidikan, 6, 3168–3175. <u>https://doi.org/10.54371/jiip.v6i5.1655</u>
- Darma, H. O., Dewi, M. P., Safitri, L., & Safitri, W. (2023). The Effect of Word Wall Media On Students' Vocabulary Mastery At The 7th Grade Of SMPN 3 Kec. Pangkalan Koto Baru. Atmosfer: Jurnal Pendidikan, Bahasa, Sastra, Seni, Budaya, dan Sosial Humaniora, 1(2), 124-136. <u>https://doi.org/10.59024/atmosfer.v1i2.68</u>.
- Denessen, E., Hornstra, L., van den Bergh, L., & Bijlstra, G. (2022). Implicit measures of teachers' attitudes and stereotypes, and their effects on teacher practice and student outcomes: A review. *Learning and Instruction*, 78, 101437. https://doi.org/10.1016/j.learninstruc.2020.101437
- Dzaiy, A. H. S., & Abdullah, S. A. (2024). The use of active learning strategies to foster effective teaching in higher education institutions. *Zanco Journal of Human Sciences*, 28(4), 328-351. <u>http://dx.doi.org/10.21271/zjhs.28.2.11</u>
- Elhefni, E., Adib, H. S., Ariani, R., & Safitri, R. (2023). Use of word wall learning media to improve learning outcomes indonesian learning in elementary schools. *AL-ISHLAH: Jurnal Pendidikan*, 15(2), 1556-1562. <u>https://doi.org/10.35445/alishlah.v15i2.1447</u>.
- Enu, J. A. O. K., Agyman, O. K., & Nkum, D. (2015). Factors influencing students' mathematics performance in some selected colleges of education in Ghana. *International Journal of Education Learning and Development*, 3(3), 68-74.
- Fernando, Y., Irawati, R., & Sunaengsih, C. (2024). Problem Based Learning Berbantuan Wordwall untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis pada Siswa Kelas III SD. Indo-MathEdu Intellectuals Journal, 5(3), 3349-3360. <u>https://doi.org/10.54373/imeij.v5i3.1289</u>.
- Fukuda, M., Fukaya, T., & Kusumi, T. (2024). Differences and Relationships Between Teachers' Pedagogical Beliefs and Teaching Strategies Used at Different School Levels in Japan. SAGE Open, 14(3), 21582440241281852. https://doi.org/10.1177/21582440241281852

- Getie, A. S. (2020). Factors affecting the attitudes of students towards learning English as a foreign language. *Cogent Education*, 7(1), 1738184. https://doi.org/10.1080/2331186X.2020.1738184
- Kele, A. (2018). Factors impacting on students' beliefs and attitudes toward learning mathematics: Some findings from the Solomon Islands. *Waikato Journal of Education*, 23(1), 85-92. <u>https://doi.org/10.15663/wje.v23i1.551</u>
- Kenderov, P., Rejali, A., Bartolini Bussi, M. G., Pandelieva, V., Richter, K., Maschietto, M., ... & Taylor, P. (2009). Challenges beyond the classroom—Sources and organizational issues. *Challenging mathematics in and beyond the classroom: The 16th ICMI Study*, 53-96. <u>http://dx.doi.org/10.1007/978-0-387-09603-2_3</u>
- Kiwanuka, H. N., Van Damme, J., Van Den Noortgate, W., Anumendem, D. K., & Namusisi,
 S. (2015). Factors affecting Mathematics achievement of first-year secondary school students in Central Uganda. *South African Journal of Education*, 35(3). https://doi.org/10.15700/saje.v35n3a1106
- Launin, S., Nugroho, W., & Setiawan, A. (2022). Pengaruh Media Game Online Wordwall Untuk Meningkatkan Minat Belajar Siswa Kelas IV. JUPEIS: Jurnal Pendidikan Dan Ilmu Sosial, 1(3), 216-223. <u>https://doi.org/10.55784/jupeis.Vol1.Iss3.176</u>
- Lindner, J., Makarova, E., Bernhard, D., & Brovelli, D. (2022). Toward gender equality in education—teachers' beliefs about gender and math. *Education Sciences*, 12(6), 373. <u>https://doi.org/10.3390/educsci12060373</u>
- Longobardi, C., Settanni, M., Lin, S., & Fabris, M. A. (2021). Student-teacher relationship quality and prosocial behaviour: The mediating role of academic achievement and a positive attitude towards school. *British Journal of Educational Psychology*, 91(2), 547-562. <u>https://doi.org/10.1111/bjep.12378</u>
- Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics. <u>http://dx.doi.org/10.29333/iejme/3997</u>
- Monte, J. (2021). An Exploration of Manipulatives in Math Education.
- Muflikhah, I. K., & Kamal, R. (2024). The Effectiveness of Using Wordwall As a Media For Mathematical Learning Assessment in Madrasah Ibtidaiyah. *AlphaMath: Journal of Mathematics Education*, 10(1), 85-96. <u>https://doi.org/10.30595/alphamath.v10i1.21582</u>.
- Mullis, I. V., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020, December). *TIMSS* 2019 international results in mathematics and science. <u>https://www.iea.nl/sites/default/files/2020-12/TIMSS%202019-International-Results-in-Mathematics-and-Science.pdf</u>
- Nafia. (2021). Efektivitas penggunaan aplikasi wordwall dalam pembelajaran daring (Online) matematika pada materi bilangan cacah kelas 1 di MIN 2 Kota tangerang selatan. *Elementar : Jurnal Pendidikan Dasar, 1*(1), 68–83. <u>https://doi.org/10.15408/elementar.v1i1.20375</u>
- Noor, .T. A., Arifin, S., & Puspitasari, I. (2023). Penerapan Media Pembelajaran Wordwall dalam Menunjang Pemahaman Konsep Siswa: Indonesia. *JIIP-Jurnal Ilmiah Ilmu Pendidikan*, 6(5), 3168-3175. <u>http://dx.doi.org/10.54371/jiip.v6i5.1655</u>

- Oladele, O. K. (2024). Kinesthetic Learning: Hands-On Learning and Active Engagement. <u>https://www.researchgate.net/publication/385619069_Kinesthetic_Learning_Hands-On_Learning_and_Active_Engagement</u>
- Pamungkas, M. D., Waluya, S. B., & Mariani, S. (2023). A Systematic Review of Complex Problem-Solving in Education and Mathematics Education. *Journal of Higher Education Theory and Practice*, 23(16), 87-101. https://doi.org/10.33423/jhetp.v23i16.6465
- Rinov, M., Cahyaningrum, Y., & Junarti, J. (2023). Implementasi Wordwall sebagai upaya Peningkatan Minat Siswa pada Era Sociality 5.0. JPM: Jurnal Pengabdian Masyarakat, 2(3), 249-266. <u>https://doi.org/10.52434/jpm.v2i3.3075</u>
- Rosado, S., & Ribeiro, J. T. (2024). Ask New and Challenging Questions Towards Reasoning Skills: Active Approaches in Higher Education. In *Transdisciplinary Approaches to Learning Outcomes in Higher Education* (pp. 180-219). IGI Global. <u>https://www.igi-global.com/chapter/ask-new-and-challenging-questions-towards-reasoningskills/353048</u>
- Sakkir, G., Azis, N., & Jabu, B. (2023). Using the Digital Game Wordwall to Enhance Efl Students' Vocabulary Mastery. *Journal of Educational Science and Technology*, 9(3), 2477-3840. <u>https://doi.org/10.26858/est.v9i3.56966</u>.
- Salsabila, A., & Tsurayya, A. (2024). The Effect of Using Edugame Wordwall on Students' Mathematical Representation Ability. *Jurnal Varidika*, 64-78. <u>https://journals2.ums.ac.id/varidika/article/view/4990/1671</u>
- Sarwendah, A. (2023). Pengaruh disovery learning berbantuan wordwall terhadap hasil belajar siswa broadcasting dan perfilman. *Fitrah: Jurnal Studi Pendidikan*, 14, 11–26. <u>https://doi.org/10.47625/fitrah.v14i1.424</u>
- Sawitri, I. G. A. L., Sudirman, S., & Paramartha, A. A. G. Y. (2019). The effect of word wall media on writing achievement of the seventh grade students of Smp Negeri 1 Seririt in academic year 2018/2019. *Language and Education Journal Undiksha*, 2(2), 43-51. <u>https://doi.org/10.23887/leju.v2i2.20298</u>.
- Şengönül, T. (2022). A review of the relationship between parental involvement and children's academic achievement and the role of family socioeconomic status in this relationship. *Pegem Journal of Education and Instruction*, 12(2), 32-57. <u>https://doi.org/10.47750/pegegog.12.02.04</u>
- Singh, C. K. S., Tao, H., Ong, E. T., Tee, T. K., Muhamad, M. M., Singh, T. S. M., ... & Maniam, M. (2023). Teachers' self-assessment of and perceptions on higher-order thinking skills practices for teaching writing. *Pegem Journal of Education and Instruction*, 13(3), 337-349. <u>https://doi.org/10.47750/pegegog.13.03.34</u>
- Sitepu, S. A. B., & Pulungan, L. H. (2024). The Effect of Word Wall Media on The Class Counting Operation Skills. *Edunesia: Jurnal Ilmiah Pendidikan*, 5(2), 779-793. <u>https://doi.org/10.51276/edu.v5i2.878</u>.
- Sulyman, H. T., & Babalola, A. T. (2023). Effect Of Classroom Wall Design On Pupl's Literacy In Ilorin East Local Government Area Of Kwara State. *Jurnal Pendidikan Ilmu Sosial*. 32(1), 107-116 https://doi.org/10.17509/jpis.v32i1.57329.
- Suryana, N. (2017). *The effectiveness of employing word wall teaching media on students' vocabulary mastery across genders* (Doctoral dissertation, Universitas Negeri Malang).

- Theobald, E. J., Hill, M. J., Tran, E., Agrawal, S., Arroyo, E. N., Behling, S., ... & Freeman, S. (2020). Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. *Proceedings of the National Academy of Sciences*, 117(12), 6476-6483. https://pubmed.ncbi.nlm.nih.gov/32152114/https://doi.org/10.1073/pnas.1916903117
- Triyani, T., Makki, M., Mustari, M., Setiadi, D., & Fahruddin, F. (2024). The Influence of Academic Supervision and Its Skills of Teachers on the Performance of High School Teachers in Sape District, Indonesia. *Path of Science*, 10(5), 3061-3069. <u>https://doi.org/10.22178/pos.104-6</u>
- Tus, J. (2020). The influence of study attitudes and study habits on the academic performance of the students. *International Journal of all research writings*, 2(4), 11-32. http://dx.doi.org/10.6084/m9.figshare.13093391.v1
- Valantinaitė, I., & Sederevičiūtė-Pačiauskienė, Ž. (2020). The change in students' attitude towards favourable and unfavourable factors of online learning environments. *Sustainability*, *12*(19), 7960. <u>https://doi.org/10.3390/su12197960</u>
- Vale, I., & Barbosa, A. (2018). Mathematical problems: The advantages of visual strategies. *Journal of the European Teacher Education Network*, *13*, 23-33