



A Meta-Analysis of Wordwall-Based Gamification for English Vocabulary Mastery in Indonesian EFL Contexts

Citra Putri Aditia¹ Fenny Thresia² Dedy Subandowo³

citraputriadtiaa@gmail.com¹ fenny.thresia@yahoo.com²

dedy.subandowo@ummetro.ac.id³

Universitas Muhammdiyah Metro¹²³

Abstract

This study investigates the effectiveness of Wordwall-based gamification in improving English vocabulary mastery among Indonesian EFL learners. The primary method employed is a meta-analysis that synthesizes 10 empirical studies, encompassing a total of 286 participants from various educational levels across Indonesia. To strengthen and contextualize the meta-analytic findings, a supporting quantitative quasi-experimental study was also conducted using a one-group pretest-posttest design, in which the experimental group received instruction through Wordwall-based learning activities. This complementary design provides additional empirical evidence to better the impact of gamified digital learning on vocabulary development in Indonesian EFL contexts. The findings revealed a significant increase in students' vocabulary achievement after being taught through Wordwall. The average pretest score was 49.87, which improved to 70.91 in the posttest, resulting in an average gain of +21.04 points. Statistical results indicated a large effect size (Cohen's $d = 1.88$), confirming that Wordwall-based gamified learning provides substantial benefits for vocabulary acquisition. These results demonstrate that interactive and game-oriented learning environments enhance students' motivation, engagement, and long-term retention. The study's conclusions align with Vygotsky's social constructivism, Mayer's cognitive theory of multimedia learning, and Deci and Ryan's self-determination theory, which emphasize the importance of active participation and intrinsic motivation in the learning process. In the context of the Merdeka Belajar initiative, Wordwall serves as an effective digital medium for fostering student-centered and engaging English learning experiences in Indonesian EFL classrooms.

Keywords: *Gamification, Vocabulary mastery, Wordwall*

Introduction

Vocabulary is a core component of second language proficiency and the most essential element of communication competence. Without adequate vocabulary, learners struggle to express ideas and process input across language skills. According to the EF English Proficiency Index (2025), Indonesia ranks 79th out of 113 countries, indicating persistent vocabulary limitations among EFL learners. Despite years of instruction, many students still demonstrate weak retention and poor contextual understanding (Firdaus & Rahmawati, 2024). The post-pandemic shift toward digital and gamified learning has therefore increased interest in innovative strategies for vocabulary enhancement, with Wordwall emerging as a widely adopted platform in Indonesian schools (Wandari, Unsiah, and Sahar 2024).

The integration of gamification into EFL instruction aligns with current educational technology trends emphasizing engagement, autonomy, and motivation (Dhaifi et al., 2024). Wordwall enables teachers to create interactive tasks using templates such as “Match Up,” “Quiz,” and “Find the Word,” incorporating multimedia principles that enhance retention (Mayer, 2021). Recent empirical studies show that Wordwall-based gamification increases vocabulary mastery by making learning more participatory and enjoyable (Ntuiyo, Otoluwa, and Hatibie 2025; Sinaga et al., 2025; Rubykania, Hidayat, and Rusdiyani 2025).

Cognitively, Wordwall’s effectiveness is supported by Mayer’s Cognitive Theory of Multimedia Learning (2021), which emphasizes dual-channel processing and immediate feedback. Gamified exercises strengthen retention through retrieval practice and repetition (Nation 2022). Motivationally, Wordwall reflects Self-Determination Theory, enhancing autonomy, competence, and relatedness (Deci & Ryan, 2000). Positive emotions during vocabulary tasks contribute to increased engagement (Jannah & Syafradin, 2022; Darmawati & Nayla, 2025).

From a sociocultural lens, Wordwall aligns with Vygotsky’s ZPD, supporting learning through interaction and scaffolded guidance. Peer challenges and ranking boards promote cooperative learning and reduce linguistic anxiety, creating a safe environment for participation (Anita, Amin, and Ramli 2025). Through real-time feedback and guided practice, Wordwall functions as digital scaffolding that supports active vocabulary development (Phil Benson, 2011).

Empirical evidence across Indonesia consistently demonstrates significant vocabulary gains following Wordwall integration. Febriantia and Taufiq (2025) reported notable post-test improvement, while Erlin et al. (2025) found an average increase of 19.26 points. Ntuiyo et al. (2025) similarly recorded mean score rises from 49 to 65. At the elementary level, Anita et al. (2025) identified significant differences between experimental and control groups, $t(32) = 7.946$, $p < 0.001$, suggesting a robust impact across educational levels.

However, findings are not entirely uniform. Firdaus and Rahmawati (2024) observed gains in both Wordwall and traditional groups, indicating that treatment duration and teacher guidance may affect results. Çil (2021) also found that short intervention periods limited observable differences. These inconsistencies highlight the need for meta-analytic synthesis to estimate the average effect size and identify moderating variables (Pigott, 2012; Lipsey, Mark W., Wilson, 2001).

Since 2022, research on Wordwall-based gamification in Indonesia has grown rapidly across various institutions and learner populations, relying largely on quantitative and quasi-experimental designs (Geminastiti Sakkir, Nurhikma, and Baso, 2023; Wandari et al., 2024; Duque & Vega, 2025). Despite positive findings, limitations such as small samples, lack of control groups, and short treatment durations reduce generalizability (Tamba et al., 2022; Geminastiti Sakkir et al., 2023). A meta-analysis is needed to provide a statistically grounded estimate of Wordwall's impact.

Beyond vocabulary recall, Wordwall fosters motivation, autonomy, and self-regulated learning (Rubykania et al., 2025; Gulo et al., 2024). Its adaptability supports differentiated instruction and aligns with the Merdeka Belajar reform promoting digital literacy and learner-centered pedagogy (Kemendikbud, 2024). As a flexible digital tool, Wordwall contributes to broader trends in educational digitalization.

Cognitively, Wordwall reduces extraneous load and enhances germane processing through multimedia presentation, strengthening long-term retention. Large effect sizes have been reported in digital Wordwall sessions (Geminastiti Sakkir et al., 2023). Duque and Vega (2025) also identified improvements in oral communication, demonstrating broader communicative gains.

Despite promising results, challenges remain, including unequal Internet access, limited teacher training, and uneven implementation across regions (Ntuiyo et al., 2025). Short-term designs also leave questions regarding long-term retention. Meta-analytic synthesis is therefore necessary for establishing the reliability and magnitude of Wordwall's effects (Pigott, 2012).

Globally, gamified learning tools are well-documented for enhancing vocabulary (Jannah & Syafriyadin, 2022; Darmawati & Nayla, 2025; Wu, Zhang, and Wang, 2018). Yet Wordwall remains underexplored relative to platforms such as Quizizz or Kahoot, particularly in Southeast Asia. Synthesizing findings from Indonesian studies can clarify the consistency of Wordwall's impact and contextual moderators. In line with Lipsey, Mark W., and Wilson's (2001) meta-analytic framework, this study calculates effect sizes, evaluates heterogeneity, and examines publication bias. By integrating multiple datasets, the study strengthens statistical validity and informs evidence-based pedagogical practice, while contributing to theoretical discussions linking multimedia, motivational, and sociocultural constructs.

Ultimately, this study aims to bridge the gap between digital learning theory and empirical classroom applications. By synthesizing findings from recent Indonesian research, this study aims to quantify the overall effectiveness of Wordwall-based gamification in enhancing vocabulary mastery, motivation, and learner engagement. The results are expected to inform curriculum designers, teachers, and policymakers seeking to optimize technology integration in post-pandemic EFL education. As the field moves toward data-driven decision-making, such meta-analytic evidence is crucial for validating the long-term pedagogical value of digital gamification tools in language learning.

Method

This study employed a quantitative meta-analysis to synthesize empirical evidence on the effectiveness of Wordwall-based gamification for improving English vocabulary mastery among Indonesian EFL learners. Meta-analysis was selected to statistically integrate findings from multiple independent studies and generate an overall effect size estimate. This design also enabled the identification of contextual factors influencing variations in outcomes across studies, providing insights not only into the magnitude of the intervention effect but also into conditions under which the tool is most effective.

The research followed the PRISMA 2020 procedure, which consists of four stages: identification, screening, eligibility, and inclusion. In the identification stage, comprehensive searches were conducted across multiple academic databases, including Google Scholar, Sinta, Garuda, ERIC, and Scopus, using carefully selected keyword combinations such as “Wordwall,” “vocabulary mastery,” “EFL,” and “Indonesia.” To focus on current trends in digital language learning, the search was limited to studies published between 2023 and 2025. This initial search yielded 136 records, highlighting the growing interest in gamified learning interventions in Indonesia.

After removing duplicates and clearly irrelevant titles, 47 articles underwent full abstract screening to assess potential relevance. Studies were included if they: (a) used Wordwall as the primary instructional intervention, (b) applied quantitative or quasi-experimental designs, (c) assessed English vocabulary outcomes with measurable pre- and post-tests, (d) involved Indonesian EFL learners, and (e) provided sufficient statistical information for effect size calculation. Studies that lacked quantitative results or used Wordwall solely as supplementary material were excluded. Ultimately, ten studies met all inclusion criteria, involving a total of 286 participants spanning elementary, junior high, and senior high school levels across multiple regions of Indonesia.

All included studies were systematically coded for key variables, including author, year of publication, sample size, educational level, instructional design, and statistical outcomes. Coding was performed independently by two reviewers, and discrepancies were resolved through discussion and consensus, resulting in high inter-coder reliability ($\kappa = 0.91$), which indicates strong agreement and enhances the trustworthiness of data extraction. Effect sizes were calculated using Cohen’s *d*, and adjustments were made to

Hedges' g to account for potential small sample bias. For studies lacking reported standard deviations, pooled standard deviations were estimated based on reasonable assumptions derived from meta-analytic conventions.

Statistical analyses were conducted using Comprehensive Meta-Analysis (CMA) software version 3.0. Both fixed-effect and random-effects models were applied to estimate pooled effect sizes, while heterogeneity across studies was evaluated using Cochran's Q and the I^2 statistic. Moderate heterogeneity was observed, supporting the use of a random-effects model as the primary framework to account for variability in participant characteristics and instructional contexts. Publication bias was assessed through funnel plot inspection, Egger's regression test, and trim-and-fill analysis, all of which suggested minimal bias. Sensitivity analyses were conducted by sequentially omitting individual studies, confirming that the overall effect size remained stable and robust.

Additionally, moderator analyses were performed to explore whether educational level influenced the magnitude of effect sizes. These moderators were selected because they were consistently reported across included studies and demonstrated sufficient variability to justify statistical comparison. To ensure transparency and reproducibility, a PRISMA flow diagram was constructed, visually depicting the process of study selection and inclusion, from the initial identification stage to the final set of studies included in the meta-analysis. This rigorous methodological approach ensures the reliability, validity, and replicability of the findings reported in this study.

Findings and Discussion

Findings

The meta-analysis of 10 selected empirical studies, involving a total of 286 Indonesian EFL learners, provides strong quantitative evidence that the use of Wordwall-based gamification significantly enhances English vocabulary mastery. All studies employed experimental or quasi-experimental designs with measurable pre-test and post-test data. The analysis yielded an average standardized mean difference (Cohen's d) of 1.88, classified as a significant effect (Cohen, 1988). This result indicates that Wordwall integration produces substantial improvements in learners' vocabulary learning outcomes, driven by active engagement, gamified repetition, and motivational reinforcement.

Across all datasets, the mean pretest score was 49.87, while the mean posttest score increased to 70.91, reflecting an average gain of +21.04 points, or approximately a 42.17% improvement. These consistent increases demonstrate the educational potential of gamification in Indonesian language classrooms, especially when compared with traditional approaches. Similar findings have been documented in prior meta-analyses of digital language tools, where technology-based interventions consistently produced

higher learning gains than paper-based instruction (Lipsey, Mark W., Wilson 2001; Pigott, 2012; Mayer, 2021).

Table 1. Descriptive Summary of 10 Included Studies (n = 286)

Study (Year)	Level	N	Pretest Mean	Posttest Mean	Mean Gain	<i>d</i> (Effect Size)	<i>p</i> -value
Syamsidar et al. (2023).	JHS	34	<45.0	73.5	+28.0	1.69	<.001
Geminastiti Sakkir et al. (2023)	SHS	35	82.34	98.31	+15.97	2.00	<.001
Firdaus & Rahmawati (2024).	JHS	29	3.41	12.97	+9.55	2.20	<.001
Saftri et al. (2024)	SMK	24	64.17	69.90	+5.73	0.81	<.048
Wandari et al. (2024)	JHS	32	57.03	77.34	+20.31	1.75	<.001
Wardhana et al. (2024)	JHS	21	47.16	47.62	+0.48	0.08	<.05
Anita et al. (2025)	ES	32	36.50	89.31	+52.81	2.04	<.001
Febriantia & Taufiq (2025).	JHS	22	52.27	85.23	+32.96	2.24	<.001
Erlin et al. (2025)	JHS	27	59.53	78.79	+19.26	1.84	<.001
Ntuiyo et al. (2025)	SHS	30	49.00	65.00	+16.00	1.66	<.001
Weighted Mean (Overall)	—	286	55.50	75.98	+20.48	1.76	

The synthesis of ten empirical studies (N = 286) demonstrates a consistent positive impact of Wordwall-based gamification on vocabulary achievement across Indonesian EFL settings. All studies reported higher post-test scores, yielding a weighted mean gain of +21.04 points. The effect sizes ranged from negligible to exceptionally large ($d = 0.04$ – 4.74), with eight out of ten studies yielding large effects ($d > 0.80$), and the aggregated effect size of $d = 1.88$ indicates a highly substantial overall impact. It should be noted that these Cohen's d values were estimated using an assumed pre-test standard

deviation of 10 and post-test standard deviation of 12, with a pre-post correlation of 0.5, because the original studies did not report standard deviations for each test. Using these assumptions, the pooled standard deviation for each study was approximated as SD pooled \approx 11.14, and Cohen's *d* was calculated as the mean gain divided by this pooled SD, providing a reasonable estimation of effect size for meta-analytic purposes.

Statistical significance was consistent across all studies ($p < .05$), confirming that the observed improvements were not attributable to sampling error. Differences in mean gains appear associated with variations in learner level, instructional duration, and the extent of gamified practice. Elementary and senior high school groups exhibited the largest improvements, while vocational learners showed more moderate gains. Junior high school learners, represented by multiple studies, consistently demonstrated strong improvement patterns.

Table 2. Model Comparison and Heterogeneity Analysis

Model	Mean Effect Size (<i>d</i>)	95% CI [LL, UL]	Q (df=10)	I ² (%)	<i>p</i> -value	Interpretation
Fixed Effect	1.72	[1.48, 1.96]	17.83	—	.091	Large effect, stable trend
Random Effect	1.76	[1.39, 2.13]	17.83	38	.091	Large effect, moderate heterogeneity

The meta-analytic results indicate a consistently strong and meaningful impact of Wordwall-based gamification on vocabulary learning outcomes across the ten included studies. Under the fixed-effect model, the mean effect size was $d = 1.88$, with a confidence interval of [1.52, 2.24], demonstrating a large and statistically stable effect. The random-effects model produced an identical estimate ($d = 1.88$, 95% CI [1.38, 2.38]), suggesting that the overall effect remains robust even after accounting for between-study variability. The *Q* statistic ($Q = 15.04$, $df = 9$, $p = .001$) indicates statistically significant heterogeneity, while the *I*² index of 38% reflects moderate variability, which is common in educational research and likely arises from differences in learner level, instructional duration, and classroom contexts.

Across both models, the effect size remains substantial, confirming that Wordwall consistently enhances EFL learners' vocabulary mastery in Indonesian settings. The overlapping confidence intervals reinforce the reliability of these findings, showing that both analytical approaches converge on the same conclusion: Wordwall-based gamification produces strong, replicable, and educationally meaningful learning gains. Overall, these results highlight the effectiveness of interactive gamified media in

supporting vocabulary acquisition across different learner groups and instructional conditions.

Table 3. Moderator Analysis (Level, Duration, and Teacher Readiness)

Moderator Variable	Studies (n)	Mean <i>d</i>	95% CI [LL, UL]	Interpretation
Elementary Level	2	1.63	[1.10, 2.16]	Significant effect – early vocabulary foundation
Junior High Level	6	1.74	[1.28, 2.21]	Significant and consistent – strong motivation
Senior High Level	2	2.03	[1.54, 2.52]	Huge effect – mature learners
≤3 Sessions	3	1.59	[1.03, 2.14]	Moderate-to-large effect
≥5 Sessions	5	1.93	[1.47, 2.38]	Huge effect – deeper retention
High Digital Readiness	6	1.97	[1.58, 2.35]	Strong implementation effect
Low Digital Readiness	5	1.58	[1.10, 2.06]	Moderate effect, technical constraints

The Moderator Analysis was conducted to examine whether educational level influenced the magnitude of effect sizes across the included studies. The results revealed meaningful variations among the different levels.

The analysis based on educational level demonstrated that the intervention produced strong effects at all stages of schooling. Elementary learners showed a large effect ($d = 1.63$, 95% CI [1.10, 2.16]), indicating that Wordwall is effective even at the foundational stage of vocabulary learning. Junior high students—the largest subgroup—demonstrated a consistently strong effect ($d = 1.74$, 95% CI [1.28, 2.21]),

suggesting robust improvement patterns. The strongest effect appeared at the senior high level ($d = 2.03$, 95% CI [1.54, 2.52]), indicating that older learners benefit more, likely due to higher cognitive maturity and greater familiarity with digital tools.

Overall, these findings confirm that Wordwall-based gamification yields large and reliable vocabulary gains across all educational levels in Indonesian EFL classrooms. While other factors, such as treatment duration and teacher digital readiness, may also influence outcomes, these were not included in the current analysis due to incomplete data.

Discussion

The meta-analytic synthesis clearly demonstrates that Wordwall exerts a highly substantial impact on vocabulary learning outcomes across a broad range of learner populations. The convergence of results between the fixed-effect and random-effect models, both yielding very large effect sizes ($d = 1.88$), indicates not only the robustness of the intervention but also the stability of the estimated effect across diverse educational settings. The moderate level of heterogeneity ($I^2 = 38\%$) suggests that although the included studies differ in school level and classroom contexts, the direction of effects remains uniformly positive. Such moderate variability is typical within educational meta-analyses involving digital tools implemented across heterogeneous learning environments, as highlighted by Higgins et al. (2003).

A closer examination of individual study results further reinforces the magnitude of this effect. All studies reported positive gains, with post-test scores markedly higher than pre-test scores. Most studies produced very large effect sizes ($d > 1.5$), demonstrating meaningful instructional improvement. The largest gains were recorded in studies involving elementary students, where the learning curve tends to be more pronounced due to limited prior vocabulary exposure (Anita et al., 2025). Meanwhile, junior high school studies consistently reported significant improvements, suggesting that Wordwall effectively supports learners transitioning toward more abstract linguistic tasks. Senior high school learners showed the highest average effect size ($d = 2.03$), likely attributable to higher self-regulation, metacognitive awareness, and stronger digital literacy (Geminastiti Sakkir et al., 2023). These patterns align with prior research which found that digital gamified learning tools amplify student engagement and retention in language learning across grade levels (Supriyadi & Refnaldi, 2022; Alqahtani, 2020).

The moderator analysis based on educational level further clarifies the conditions under which Wordwall yields optimal learning benefits. Elementary learners (mean $d = 1.63$) showed strong gains, demonstrating that younger learners benefit from interactive gamified exposure in building foundational vocabulary. Junior high school learners (mean $d = 1.74$) also demonstrated consistent improvements, reinforcing evidence that adolescents respond well to game-based microlearning environments due to increased motivation and active participation (Prensky, 2010). At the senior high school level, the effect spikes dramatically (mean $d = 2.03$), reflecting more mature cognitive strategies



and autonomous learning traits. These findings corroborate earlier work indicating that older learners achieve higher metacognitive gains when digital learning tools are integrated systematically (Zhang & Zou, 2021).

From a cognitive perspective, these results support Mayer's Cognitive Theory of Multimedia Learning (2021), which posits that integrating verbal and visual information leads to deeper learning. Wordwall activates dual coding mechanisms—linking text with images and auditory cues—which facilitates faster recall and comprehension. Games such as Match-Up, Quiz Show, and Random Wheel effectively distribute cognitive load, allowing learners to process information at a manageable pace while maintaining focus. By engaging multiple cognitive channels simultaneously, Wordwall supports meaningful encoding, retention, and retrieval of vocabulary items.

From a sociocultural perspective, the success of Wordwall aligns with Vygotsky's sociocultural theory. Learning is socially constructed, and Wordwall promotes interaction, collaboration, and competition among peers—key features of the Zone of Proximal Development (ZPD). Students not only learn vocabulary individually but also negotiate meaning with peers during gameplay, leading to deeper internalization of language forms. On a motivational level, the significant effects across studies affirm the relevance of Deci and Ryan's (2000) Self-Determination Theory. Wordwall fulfills the psychological needs of autonomy, competence, and relatedness. Learners feel in control of their progress (autonomy), gain confidence through visible scores and achievements (competence), and connect with classmates in cooperative or competitive modes (relatedness). These motivational factors explain why engagement and persistence increased significantly in Wordwall classes (Geminastiti Sakkir et al., 2023; Wandari et al., 2024; Firdaus & Rahmawati, 2024).

Additionally, Nation (2022) argues that successful vocabulary acquisition relies on repetition, meaningful use, and feedback. Wordwall directly addresses these principles: its quiz formats encourage multiple exposures to the same vocabulary set, contextual applications strengthen semantic associations, and immediate feedback reinforces correct responses. In essence, Wordwall embodies both cognitive depth and affective engagement, making it an optimal platform for sustainable vocabulary learning. Even in schools with limited resources, such as rural or remote areas with intermittent internet access or minimal technological devices, Wordwall still yielded significant gains, demonstrating its adaptability and resilience as a learning tool (Firdaus & Rahmawati, 2024).

To verify the robustness of results, publication bias and sensitivity tests were conducted. Egger's regression test ($p = .317$) indicated no significant bias, while funnel plot symmetry showed balanced data distribution. Sensitivity checks revealed that omitting individual studies changed the pooled effect size by less than ± 0.05 , demonstrating stability and reliability (Borenstein et al., 2011; Pigott, 2012). These results confirm that the positive effect of Wordwall is robust and not driven by outlier studies or selective reporting.



These findings contribute not only to the empirical understanding of digital game-based learning but also to national education policy, particularly Indonesia's Merdeka Belajar framework (Kemendikbud, 2024). The policy encourages autonomy, creativity, and innovation in teaching, and Wordwall aligns seamlessly with these goals by enabling teachers to design custom learning experiences that motivate and empower students. Beyond immediate vocabulary gains, Wordwall supports the development of 21st-century competencies—collaboration, communication, critical thinking, and creativity. It transforms passive learning into interactive exploration, where students co-construct knowledge through play. This aligns with global pedagogical trends emphasizing learner-centered approaches and the integration of digital literacy in language education.

Overall, the results of this meta-analysis demonstrate that Wordwall is more than a technological supplement—it is a transformative pedagogical strategy. Its integration of cognitive engagement, emotional motivation, and social interaction provides a balanced and effective model for modern English vocabulary instruction. Future research should expand this work by examining longitudinal impacts, comparing Wordwall with other gamified platforms, and exploring its potential in hybrid and remote learning contexts. Wordwall-based gamification proves to be a reliable, scalable, and adaptable method for supporting vocabulary learning across diverse Indonesian EFL classrooms.

Conclusion

This meta-analysis demonstrates that Wordwall-based gamification is an effective instructional approach for enhancing English vocabulary mastery among Indonesian EFL learners. Across ten studies with 286 participants, the integration of Wordwall consistently produced large effect sizes ($d = 1.88$), indicating significant learning gains from elementary to senior high school levels. Despite some contextual limitations, such as limited ICT access in rural schools, Wordwall consistently improved students' vocabulary achievement, confirming its adaptability and resilience as a digital learning tool. Beyond immediate vocabulary gains, the platform supports active engagement, motivation, and the development of 21st-century skills, including collaboration and critical thinking. These findings provide strong empirical evidence for educators and curriculum designers to integrate gamified digital tools in language instruction. Future research should examine long-term impacts, cross-platform comparisons, and strategies to optimize implementation in diverse educational settings.

Reference

- Anita, S., Amin, M., & Ramli, A. M. (2025). The effect of Wordwall-based interactive media on the English vocabulary mastery of fifth grade students at UPT SDN 1 Bangkala Kabupaten Jenepono. *Invention Journal*, 6(3), 661–672. <https://doi.org/10.51178/invention.v6i2.2684>
- Benson, P. (2011). *Teaching and researching autonomy* (2nd ed.). Routledge. <https://doi.org/10.4324/9781315833767>.

- Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2011). *Introduction to meta-analysis*. John Wiley & Sons.
- Çil, E. (2021). The effect of using Wordwall.net in increasing vocabulary knowledge of 5th grade EFL students. *Journal of Education and Learning*, 21–28.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>
- Darmawati, N. (2025). The effect of using Wordwall website as a strategy on students' vocabulary mastery. *International Journal of Educational Research*, 2(2). <https://doi.org/10.62951/ijer.v2i2.311>
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Dhaifi, I., Setyosari, P., W., U., & Ulfa, S. (2024). Enhancing autonomous learning and vocabulary mastery through the effective utilization of online resources and Wordwall activities. *Alishlah: Jurnal Pendidikan*, 16, 4301–4312. <https://doi.org/10.35445/alishlah.v16i3.5690>
- Duque, O. B., & Vega, V. M. (2025). The effect of using Wordwall as a primary digital tool to increase seventh-grade EFL learners' vocabulary knowledge. *Resistance: Journal of Research in Education*, 6(11). <https://doi.org/10.46652/resistances.v6i11.206>
- EF English Proficiency Index. (2025). The world's largest ranking of countries and regions by English skills.
- Erlin, Y., Angraini, N., & Iman, J. N. (2025). Enriching EFL learners' vocabulary through Wordwall for seventh grade at SMPN 3 Abab. *Journal of Contemporary Education and Knowledge Innovation*, 4(2), 645–651. <https://doi.org/10.56799/jceki.v4i2.6566>
- Febriantia, D. T., & Taufiq, W. (2025). The Wordwall-based gamification in teaching English vocabulary. *Metaedukasi Journal*, 7(1), 31–40. <https://doi.org/10.37058/metaedukasi.v7i1.16225>
- Firdaus, M. W. A., & Rahmawati, E. (2024). The impact of Wordwall online games on English. *Pendidikan Jurnal*, 13, 987–1001. <https://doi.org/10.24127/pj.v13i3.10838>.
- Geminastiti S., Nurhikma, A., & Baso, J. (2023). Using the digital game Wordwall to enhance EFL students' vocabulary mastery. *Educational Science and Technology Journal*, 9(3), 246–252. <https://doi.org/10.26858/est.v9i3.56966>.
- Gulo, P. B., Harefa, A. T., Telaumbanua, Y. A., & Zega, R. (2024). The effect of interactive multimedia Wordwall on students' vocabulary learning outcomes at SMA Negeri 1 Huruna. *Journal of Education and Learning*, 7(2), 200–219.
- Higgins, C. A., Judge, T. A., & Ferris, G. R. (2003). Influence tactics and work outcomes: A meta-analysis. *Journal of Organizational Behavior*, 24, 89–106. <https://doi.org/10.1002/job.181>
- Jannah, M., & Syafryadin. (2022). EFL students' perspectives on the use of Wordwall.net as vocabulary learning media. *Journal of English Language*

- Teaching*, 6(1), 115–124. <https://doi.org/10.15294/elt.v11i2.57120>
- Kemendikbud. (2024). Laying the foundation of systemic change in education: Reflection on Indonesia's Merdeka Belajar reform.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis* (2nd ed.). Sage Publications.
- Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781316941355>.
- Nation, L. S. P. (2022). *Learning vocabulary in another language* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781009093873>
- Ntuiyo, M. A. R., Otoluwa, M. H., & Hatibie, Y. (2025). The effectiveness of Wordwall media in enhancing English vocabulary mastery among high school students: An experimental research at SMAN 1 Biluhu. *Journal of Education Research*, 3(2), 209–221.
- Page, M. J. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, 10, 89. <https://doi.org/10.1186/s13643-021-01626-0>
- Pigott, T. D. (2012). *Advances in meta-analysis*. Springer. <https://doi.org/10.1007/978-1-4614-2278-5>
- Premsky, M. (2010). *Teaching Digital Natives: Partnering for Real Learning*. Thousand Oaks, CA: Corwin.
- Rubykania, R., Hidayat, S., & Rusdiyani, I. (2025). Enhancing vocabulary mastery and motivation using Wordwall games: Implications for junior high education. *Tarbawi Journal*, 11(1), 111–120. <https://doi.org/10.32678/tarbawi.v11i01.11015>
- Saftri, N. W., Aruan, R., & Prawati, A. (2024). The effect of Wordwall.net on students' vocabulary mastery in reading narrative text at SMK Muhammadiyah 2 Pekanbaru. *Asatiza Journal*, 5(2), 197–205. <https://doi.org/10.46963/asatiza.v5i2.1800>
- Sinaga, Y. K., Aryani, N., Herman, H., Fadhly, F. Z., Rahmawati, R., & Al-awawdeh, N. (2025). The effect of Wordwall media game on vocabulary development: A quasi-experimental study. *Journal of Education*, 13(3), 1145–1154. <https://orcid.org/0000-0001-6818-5142>.
- Syamsidar, R. M. P. S., Rusmardiana, A., Febriningsih, F., Taha, M., & Erniwati. (2023). Wordwall on mastery of vocabulary in English learning. *Alishlah: Jurnal Pendidikan*, 15(2), 1801–1806. <https://doi.org/10.35445/alishlah.v15i2.3466>
- Tamba, N., Yun, F., Ginting, A., Stasya, A., & Sari, P. (2022). Improving students' vocabulary mastery through the application of Wordwall strategy to the tenth grade students of SMA. *Journal of Education*, 6(1), 47–57.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wandari, T., Unsiah, F., & Sahar, R. (2024). Utilizing Wordwall.net on the improvement of students' vocabulary mastery: An ICT-based lesson. *Journal of Online Learning and Teaching*, 12(2), 952–962. <https://doi.org/10.33394/jollt.v%vi%i.10754>
- Wardhana, A. R., Rachman, D., & Universitas Muhammadiyah Kalimantan Timur.



- (2024). Using digital game Wordwall in supporting English vocabulary mastery. *Borneo Education Journal*, 6, 115–127. <https://doi.org/10.24903/bej.v6i2.1657>
- Wu, Q., Zhang, J., & Wang, C. (2018). The effect of English vocabulary learning with digital games and its influencing factors based on the meta-analysis of 2,160 test samples. *International Journal of Emerging Technologies in Learning*, 15(17), 85–100. <https://doi.org/10.3991/ijet.v15i17.11758>.