Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. Juni 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

DEVELOPMENT OF *WORDWALL* GAMES TO IMPROVE LITERACY AND NUMERACY IN EARLY CHILDHOOD 5-7 YEARS OLD

Siti Alifah Faiz[1a*], Herpratiwi[2b], Dwi Yulianti[3c]

[123] Department of Master Educational Technology, Lampung University, Indonesia

[*a]*E-mail:* alifahgurupaud@gmail.com,
[*b]*E-mail:* herprawtiwi64@yahoo.com,
[*c]*E-mail:* dwi.yulianti@fkip.unila.ac.id

(*) Corresponding Author:
alifahgurupaud@gmail.com

ARTICLE HISTORY
Received : 20-01-2026
Revised : 07-02-2026
Accepted : 15-04-2026

KEYWORDS
Early Childhood Education;
Educational Game;
Literacy;
Numeracy;
R&D Method;
Wordwall;

ABSTRACT
Literacy and numeracy skills constitute foundational prerequisites in early childhood education and play an essential role in preparing children for subsequent levels of education. This study aimed to develop a digital technology-based educational game using the Wordwall platform to support the improvement of literacy and numeracy skills among children aged 5–6 years. The study employed a Research and Development (R&D) method using the ADDIE development model, which consists of analysis, design, development, implementation, and evaluation stages. The research was conducted at Khalifah Kindergarten, Jati Agung, South Lampung, involving media expert validation, material expert validation, and product trials with 15 early childhood students. The findings revealed that the developed Wordwall educational game achieved a validity score of 97% from media experts and 92% from material experts, both categorized as "very feasible." In addition, the product trial obtained an 84% response rate in the "strongly agree" category, indicating positive learner engagement with the developed media. The effectiveness of the Wordwall educational game in improving literacy and numeracy skills is associated with its ability to provide interactive, visual, and scaffolded learning experiences that align with the developmental characteristics of early childhood learners. The integration of multimodal elements, such as images, audio, text, and game-based challenges, supported exploratory learning and self-paced progression during classroom activities. Theoretically, this study reinforces the concept of digital game-based learning in early childhood education by demonstrating that interactive digital media can facilitate meaningful and developmentally appropriate learning experiences. Practically, the study provides educators with a scalable, low-cost, and pedagogically sound tool that can be utilized to support literacy and numeracy learning in early childhood classrooms.

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INTRODUCTION

Literacy and numeracy are two key foundations in early childhood education that play a major role in children's readiness for the next level of education. Literacy encompasses the ability to understand and use language, both spoken and written, including skills such as listening, speaking, reading, and writing. Numeracy refers to the ability to understand and apply basic mathematical concepts, including number recognition, patterns, and simple operations. Strong literacy and numeracy skills in early childhood have been shown to have a long-term positive impact on children's cognitive development, critical thinking abilities, and academic success (Kim & Smith, 2019). Therefore, the quality of early childhood literacy and numeracy development is widely regarded as a strong predictor of future academic achievement.

However, traditional educational approaches, such as one-way teaching and worksheet-based methods, are often ineffective in stimulating children's curiosity and independent learning. Considering that early childhood learners generally have shorter attention spans, they require more interactive and engaging learning approaches. In the digital era, technology has become an integral part of various aspects of life, including education. Rapid advancements in digital technology require educators to adapt to children's learning characteristics and design playful and meaningful learning environments (Nikken & Opree, 2018). The integration of digital media—incorporating multimodal elements such as text, images, audio, video, and animation—has attracted increasing attention in early childhood education, as it enables immersive, interactive, and contextually rich learning experiences.

The use of digital technology in early childhood education is unavoidable; however, it must be implemented wisely with appropriate guidance, supervision, and support from teachers and parents (Lindriany et al., 2022). One promising approach is the use of digital-based educational games, which offer advantages over conventional methods by actively involving children in the learning process through engaging game elements. These games are typically designed with progressive levels and challenges that encourage continuous development of literacy and numeracy skills. Research by Tan and Ng (2022) demonstrates that interactive educational games can significantly improve early childhood literacy and numeracy abilities, including letter and word recognition, as well as basic counting skills, compared to traditional learning methods. Similarly, research by Maghfirah et al. (2022) shows that digital media is effective in stimulating numeracy skills, particularly in number recognition and basic arithmetic operations in early childhood education settings.

Despite these advantages, a critical limitation remains. Commercially available educational games often prioritize entertainment over pedagogical alignment, resulting in learning experiences that may lack depth and fail to optimally support children's cognitive development. Effective educational games should be designed based on early childhood education principles, integrating appropriate learning content with visually and auditorily engaging elements, as well as difficulty levels that align with children's developmental stages (Park & Lee, 2020). Furthermore, such games should incorporate meaningful learning interactions rather than merely providing superficial engagement.

The development of digital-based educational games for early childhood requires a strong understanding of children's characteristics and learning styles. Early childhood learning is inherently play-based, involving direct experience, exploration, experimentation, and social interaction. Therefore, educational games should be designed to be engaging, challenging, and capable of facilitating independent learning with appropriate adult guidance. In addition, these games should include motivational features such as rewards, progressive challenges, and visually appealing interfaces to sustain children's interest and engagement (Cheng & Wang, 2023). Children who develop strong literacy and numeracy skills at an early age are better prepared to face academic challenges and have greater opportunities for success in various fields.

To address this gap, this study focuses on the development of interactive and user-friendly digital learning media through the utilization of the Wordwall platform. Wordwall offers various interactive features that can actively engage learners in the learning process. The use of this platform is expected to create a more engaging, enjoyable, and meaningful learning experience, while also enhancing children's participation, motivation, and literacy and numeracy skills. This research specifically aims to develop digital-based educational games that are tailored to the cognitive

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development needs of children aged 5–6 years, incorporating visually and auditorily appealing elements as well as adaptive learning features.

Previous studies have demonstrated the effectiveness of Wordwall as a learning medium. Research by Ritonga and Gandamana (2023) indicates that the use of Wordwall interactive game media is highly practical in classroom learning. Furthermore, Gandasari and Pramudiani (2021) found that the Wordwall application has a significant impact on students' understanding of learning materials, as well as on their motivation and interest in learning. These findings suggest that interactive digital media can enhance student engagement and learning outcomes.

Based on the explanation above, this study is conducted under the title "Development of Wordwall Educational Games to Improve Literacy and Numeracy in Early Childhood Ages 5–6 Years." The results of this study are expected to contribute to the development of innovative technology-based learning media that align with children's learning needs and support government efforts to improve the quality of early childhood education. In addition, this research is expected to provide valuable references for educators and educational technology developers in designing adaptive and effective learning media. This study also supports previous findings indicating that digital educational games have a positive impact on early childhood literacy and numeracy development (Johnson & Brown, 2021; Tan & Ng, 2022), thereby offering new opportunities to utilize technology as an effective and engaging educational tool in the digital era.

METHOD

This learning media development research was conducted using the R&D (Research and Development) method with the ADDIE development model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The R&D (Research and Development) method, known as an approach that focuses on the systematic planning, development, and evaluation of instructional programs, processes, or products that must meet consistency and effectiveness criteria. The ADDIE model was chosen because it allows for evaluation and improvement at each stage, which ensures that the final product has high validity. The use of the ADDIE model has also proven effective in developing learning media. This development research is a process used to create and validate educational products, especially learning media. The resulting product goes through a validation process by a number of experts in their fields and product trials. Product trials aim to determine the feasibility of media designed for early childhood literacy and numeracy learning. The small group trial involved 15 children aged 5-6 years at Khalifah Kindergarten, Jetis Karang Anyar. This trial was conducted to assess the benefits, convenience, and effectiveness of the products developed.

Data collection was carried out through media and material feasibility assessments, using evaluation sheets collected from media experts. This assessment aims to determine the extent to which learning media can stimulate early childhood literacy and numeracy skills.

RESULTS AND DISCUSSION

This learning media development research uses the R&D (Research and Development) method, focusing on the development of literacy and numeracy media designed to improve children's abilities. Haris Budiman in his research argues that the use of learning media serves as a tool for teachers, makes it easier for students to understand the material presented, and reduces boredom that often arises in learning that only relies on verbal methods. This makes the learning process more interesting and effective.

The specifications of the developed product are as follows: First, this Educational Game is a website called wordwall, its use is very easy, no need to install the application, can be accessed for free with basic features making it easier for teachers to design interactive games suitable for early childhood. Second, this media serves as an innovative tool to help teachers deliver literacy and numeracy learning interactively to students, this website supports online and offline learning because the material can be printed or played directly on a computer, tablet or cellphone. Third, with this educational game, learning is more fun, interesting, more active in the learning process and students more easily understand the material presented. These features support exploratory learning and self-paced progression,

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allowing children to interact with literacy and numeracy materials according to their developmental readiness while reducing cognitive fatigue during the learning process.

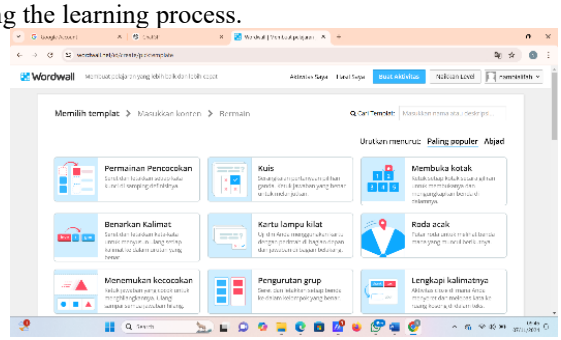

Figure 1. View of "Wordwall" website

In Figure 1, this is the initial appearance of the "Wordwall" website. The wordwall website has a variety of game templates to choose from. Wordwall offers a variety of templates, such as multiple choice quiz, crossword, puzzles, random wheel, tile game, word search, matching, and others, which can be customized with learning content. The availability of diverse templates enables teachers to design varied learning experiences that maintain children's attention and support active engagement during literacy and numeracy activities.

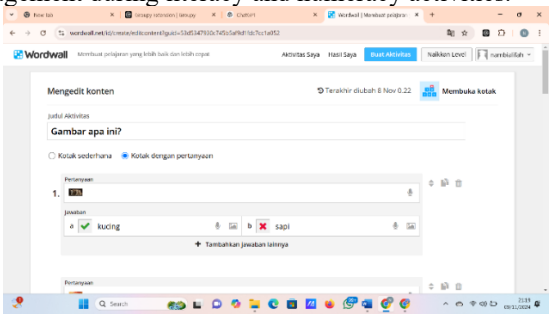

Figure 2. Content editing view

In This is a display of the page editing content or creating game material. On this page you can create activities or learning materials that can be displayed in the game later. On this page, you can enter images, text and sound to support the game material that will be displayed to students later. The integration of visual, textual, and auditory elements reflects a multimodal learning approach that is considered appropriate for early childhood learners, as children tend to learn more effectively through concrete and interactive experiences.

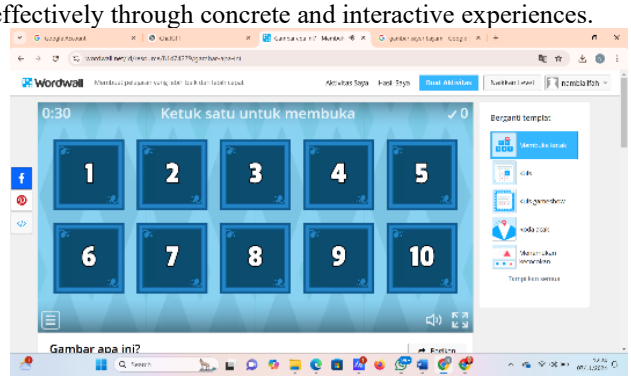

Figure 3. Wordwall game view

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This is the initial display of the wordwall game. On this page, it displays several game options that will appear when students choose the numbers. This visual display can be added or reduced according to the learning material that will be displayed. This flexible structure allows teachers to adapt the level of difficulty and content complexity according to children's literacy and numeracy development stages.

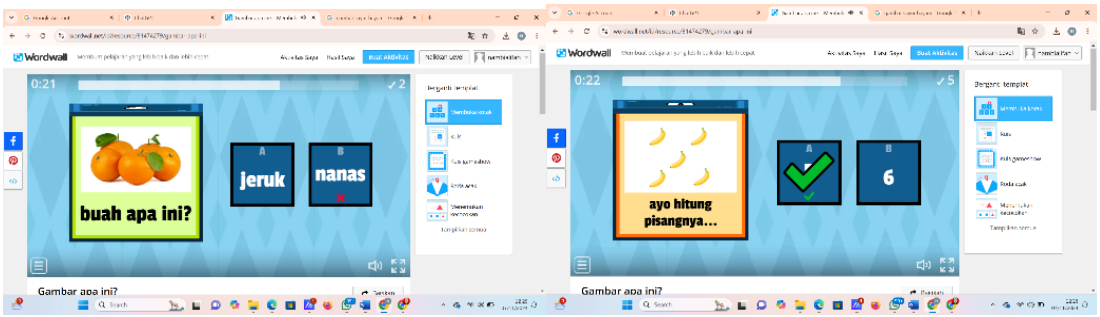

Figure 4. Visual display of wordwall game

This is a visual display of wordwall games that children can play, each number selected has a different image and command. In this wordwall game display, children can answer the questions on the display and choose the correct answer accompanied by time, so that it can make the learning atmosphere more interesting and challenging. The use of interactive challenges and time indicators encourages children's active participation while maintaining engagement throughout the learning activity. However, the purpose of these features is not merely to increase entertainment value, but to support meaningful interaction with literacy and numeracy concepts.

The interactive wordwall game developed by researchers consists of several skill levels designed to stimulate literacy and numeracy skills in early childhood. The visual page of the wordwall game displays images, text and audio that have meaning in learning. The skills developed include: understanding expressive language (expressing language verbally and non-verbally), show early literacy skills, mention number symbols 1-10, use number symbols to count, represent various objects in the form of pictures or writing and train the ability to express opinions using simple sentences. These skill components indicate that the developed media not only focuses on academic achievement, but also supports communication skills and children's confidence in expressing ideas during the learning process.

At the Analysis stage, a study is carried out regarding the needs that must be met in the development of wordwall educational game learning media. This analysis stage is divided into two parts, namely performance analysis and needs analysis. Performance analysis aims to identify problems that exist in Khalifah Kindergarten, Jati Agung South Lampung, especially related to literacy and numeracy skills of children aged 5-6 years. It is known that the literacy and numeracy skills of students at Khalifah Kindergarten, Jati Agung South Lampung have not met the expected standards for this age group, which requires a special approach in the learning process, and the learning process still does not utilize digital technology that can help make the learning process more interesting, interactive and meaningful. In addition, it was found that some children were less focused and felt bored during learning, because the media used was not interesting enough for early childhood. Based on this problem, learning media that is more in line with the needs of children is needed. Furthermore, a needs analysis was conducted to determine the right type of learning media that can overcome problems in literacy and numeracy learning for children aged 5-6 years. Thus, researchers developed a wordwall educational game media that is expected to increase focus, reduce boredom of learners and increase their involvement in the literacy and numeracy learning process. These findings strengthen the argument that early childhood learning requires interactive and developmentally appropriate media that can sustain children's concentration and participation during classroom activities.

At the design stage, researchers developed an initial design of wordwall educational game media to stimulate literacy and numeracy skills in children aged 5-6 years. At this stage, researchers design various aspects of the media to be developed, starting from the selection of templates, visual displays, images according to the material, audio and other elements. Media expert validation is carried out by looking at the quality of wordwall educational games as

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learning media. Media experts are then asked to provide an assessment of the wordwall educational game media developed as a medium for learning literacy and numeracy for children aged 5-6 years. In this study, it was assessed by Mrs. Dr. Dina Marta Fitri, M.Pd as a Lecturer in Educational Technology as a media expert. The results of media expert validation can be seen in the following table:

Table 1. Results of Media Expert Validation Test

No.	Indicator	Evaluation	Criteria
1	Appearance suitability for children aged 5-6 years	4	Good
2	Games according to the characteristics of children aged 5-6 years	4	Good
3	Games can stimulate children to recognize letters and increase vocabulary.	4	Good
4	The game can be played by children aged 5-6 years	3	Good enough
5	The visual appeal presented	4	Good
6	Training the speaking skills of children aged 5-6 years	4	Good
7	Educational game learning media wordwall as a support for literacy and numeracy learning materials	4	Good
8	Benefits in Supporting Literacy	4	Good
9	Usefulness in Supporting Numeracy	4	Good
10	Game Suitability with Learning Objectives	4	Good
	Amount	39	
	Validity percentage	97%	Very good, no need for revision

Based on the results of media expert validation, the Wordwall educational game obtained a validity percentage of 97% with the category “very good” and no revision required. This result indicates that the developed media has fulfilled important aspects of educational media quality, including visual suitability, usability, alignment with learning objectives, and relevance to children's developmental characteristics. The high score on visual attractiveness and literacy-numeracy support also suggests that the media has the potential to reduce cognitive fatigue and maintain children’s learning motivation through interactive activities.

Material expert validation is carried out with statements related to the explanation of the material contained in the wordwall educational game. Furthermore, the material expert validator is requested to provide an assessment of the media developed. In this study, it was assessed by Mrs. Yusi Sofani, S.Pd as the Principal of Khalifah Kindergarten as a material expert. The results of the material expert validation can be seen in the following table:

Table 2. Results of Material Expert Validation Test

No.	Indicator	Evaluation	Criteria
1	This learning media material is appropriate for the achievement level of children aged 5-6 years	4	Good
2	Games according to the characteristics of children aged 5-6 years	4	Good
3	Games can stimulate children to recognize letters and increase vocabulary	3	Good enough
4	Games can stimulate children to recognize numbers 1-10 and the concept of counting.	3	Good enough
5	The game can be played by children aged 5-6 years	4	Good
6	Training the speaking skills of children aged 5-6 years	4	Good
7	Educational game learning media wordwall as a support for literacy and numeracy learning materials	4	Good
8	Train skills in simple counting concepts	4	Good

Sosioedukasi
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Volume 15 No. 2. Juni 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

9	Stimulating the reading, writing and arithmetic skills of children aged 5-6 years	3	Good enough
10	Presentation of material is able to develop the thinking power/imagination of children aged 5-6 years	4	Good
	Amount	37	
	Validity percentage	92%	Very good, no need for revision

Based on the material expert validation results, the developed media obtained a validity percentage of 92% with the category "very good" and no revision required. The findings demonstrate that the learning content contained in the Wordwall educational game is appropriate for the developmental achievement level of children aged 5-6 years. In addition, the positive evaluation on literacy and numeracy indicators indicates that the media can facilitate meaningful learning experiences through interactive and contextual activities.

Wordwall educational games in the aspects of content, language, presentation and visual feasibility can be concluded to have valid validity. Overall, the media aspects can be concluded to have good quality and are suitable for use in learning literacy and numeracy for children aged 5-6 years. These findings are consistent with previous studies by Ritonga & Gandamana (2023) and Gandasari and Pramudiani (2021), which emphasize that interactive digital learning media can improve student engagement and understanding. However, this study extends previous findings by specifically focusing on early childhood literacy and numeracy stimulation through adaptive and interactive game-based activities.

At this implementation stage, learning media is carried out in the learning process at school, especially in the literacy and numeracy skills of children aged 5-6 years at Khalifah Kindergarten, Jati Agung South Lampung. By conducting product trials involving students to find out the response of students and the attractiveness of wordwall educational game media. Product trials were conducted involving 15 students. The trial was conducted to determine the learner's response and the attractiveness of the developed product.

Table 3. Results of Observation of Trial on Students

No.	Indicator	Total Percentage	Criteria
1	Understanding receptive language through stories	80	Strongly agree
2	Understanding expressive language (expressing language verbally and non-verbally)	88	Strongly agree
3	Demonstrate early literacy skills in a variety of forms of work	86	Strongly agree
4	Mention the symbols for numbers 1-10	82	Strongly agree
5	Using number symbols to count	85	Strongly agree
6	Representing various objects in the form of pictures or writing	85	Strongly agree
	P= $\frac{skor\ hasil\ penelitian}{skor\ maksimal} x100\%$	84%	Strongly agree

Based on the learner response test in the product trial involving 15 students aged 5-6 years at Khalifah Kindergarten Jati Agung, South Lampung, it was found that the learning media product obtained a percentage of 84% with the category "strongly agree". So based on the criteria set, it can be concluded that the observation sheet for literacy and numeracy skills of children aged 5-6 years using wordwall educational game media is very agreeable and feasible to use to stimulate the literacy and numeracy skills of children aged 5-6 years. The positive responses from students indicate that the interactive features of the media were able to increase participation and sustain attention during learning activities. This finding also suggests that interactive digital games may help create a more enjoyable learning environment that supports exploratory learning and active involvement among early childhood learners.

This stage is the stage of assessing the results of the feasibility of wordwall educational games by expert experts and assessing children's literacy and numeracy skills, so that a conclusion is obtained whether or not the feasibility of

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the wordwall educational game developed is feasible. Researchers developed wordwall educational game learning media as a learning medium to stimulate literacy skills and numeracy of children aged 5-6 years in Khalifah Jati Agung Kindergarten, South Lampung. There are problems found related to the literacy and numeracy skills of children aged 5-6 years, which are known to be the learning media used in the literacy and numeracy learning process is less varied, making children less focused and children feel bored in the learning process in the classroom. A solution is needed to develop a learning media that is used to stimulate the literacy and numeracy skills of children aged 5-6 years, so that children do not feel bored and have difficulty focusing when learning literacy and numeracy. The wordwall educational game developed in this study is an interesting digital technology-based learning media and can motivate children to be active in literacy and numeracy learning process activities in early childhood. These findings support the view that technology-based learning media can function not only as instructional tools but also as learning environments that encourage interaction, engagement, and independent exploration in early childhood education.

CONCLUSION

The development of wordwall educational game learning media has been proven effective in improving literacy and numeracy skills of children aged 5-6 years. The results of the validity test of the research have been developed with a valid category and are suitable for use in classroom learning. The results of media expert validation obtained results of 97% with a very feasible category. The results of the material expert validation obtained a result of 92% with a very feasible category. Based on the test of students' responses to the product trial involving 15 students aged 5-6 years at Khalifah Kindergarten Jati Agung, South Lampung, it was found that the learning media product obtained a percentage of 84% in the “strongly agree” category. proves that wordwall games are able to increase children's focus, involvement, and learning motivation in literacy and numeracy learning. This game not only helps children understand literacy and numeracy concepts better, but also provides a holistic and contextual learning experience, which involves various senses and encourages children's exploration.

Learning media development products such as Wordwall games open new avenues in early childhood education in the digital era. This game provides an effective solution to overcome the limitations of traditional methods that tend to be monotonous and less interesting for children. With a more interactive and contextual approach, this digital learning media acts as a tool that can stimulate early childhood literacy and numeracy skills. In addition, this wordwall game can enhance creativity, improve critical thinking skills, and prepare children for future academic challenges. This research is also an important reference for educators and educational technology developers in creating media that is relevant, adaptive and in line with children's developmental needs.

Theoretically, this study contributes to the development of technology-based learning theories in early childhood education, particularly regarding the integration of interactive digital games as developmentally appropriate learning media for literacy and numeracy stimulation. This study also strengthens the understanding that digital game-based learning can support meaningful and child-centered learning experiences through multimodal interaction and self-paced progression.

Practically, the findings of this study provide useful references for teachers, schools, and educational technology developers in designing and implementing adaptive digital learning media that align with children’s developmental characteristics and classroom needs. Furthermore, this study offers an applicable example of how digital platforms such as Wordwall can be utilized to create engaging and effective learning environments in early childhood education settings.

REFERENCES

Aini, Q., & Budiyanto, C. (2021). Pengembangan media Wordwall untuk meningkatkan kemampuan literasi anak usia dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 5*(2), 1905–1916. https://doi.org/10.31004/obsesi.v5i2.743

Fadillah, M. (2020). Game-based learning for early childhood: A case study of Wordwall implementation. *Journal of Early Childhood Care and Education, 3*(1), 12–25.

Sosioedukasi
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Volume 15 No. 2. Juni 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

Gandasari, P., & Pramudiani, P. (2021). Pengaruh aplikasi Wordwall terhadap motivasi belajar IPA siswa di sekolah. *Jurnal Edukatif: Jurnal Ilmu Pendidikan, 3*(6), 3689–3696. https://doi.org/10.31004/edukatif.v3i6.1079

Kurniawan, A. R., & Chanifah, N. (2023). Wordwall game untuk meningkatkan literasi digital anak usia dini. *Jurnal Pendidikan Guru PAUD, 8*(1), 1–12.

Lindriany, J., Hidayati, D., & Nasaruddin, D. M. (2022). Urgensi literasi digital bagi anak usia dini dan orang tua. *Journal of Education and Teaching (JET), 4*(1), 35–49. https://doi.org/10.51454/jet.v4i1.201

Maghfirah, F., Satriana, M., Sagita, A. D. N., Jafar, F. S., Yindayati, & Norhafifah. (2022). Media digital menstimulasi keterampilan numerasi anak usia dini di lembaga PAUD. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 6*(6), 6027–6034. https://doi.org/10.31004/obsesi.v6i6.3370

Mason, J., Khan, K., & Smith, S. (2016). Literate, numerate, discriminate-realiging 21st century skills. In *Proceedings of the 24th International Conference on Computers in Education* (pp. 609–614). Asia-Pacific Society for Computers in Education.

Mustafa, N. F., et al. (2022). The effectiveness of Wordwall in enhancing early literacy skills among preschoolers. *International Journal of Interactive Mobile Technologies (iJIM), 16*(5), 4–15. https://doi.org/10.3991/ijim.v16i05.25567

Nikken, P., & Opree, S. J. (2018). Guiding young children's digital media use: SES-differences in mediation concerns and competence. *Journal of Child and Family Studies, 27*(6), 1844–1857. https://doi.org/10.1007/s10826-018-1018-3

Nuraini, N. L. S., Cholifah, P. S., Oktiningrum, W., & Mahartania, S. Q. G. (2022). Developing digital game based learning to support numeracy of elementary school teacher education students. In *2022 2nd International Conference on Information Technology and Education (ICIT&E)* (pp. 408–413). https://doi.org/10.1109/ICITE54466.2022.9759856

Nurjanah, S., & Fahrurrozi. (2020). Pengaruh media Wordwall terhadap kemampuan berhitung anak usia dini. *Jurnal Pendidikan Anak, 9*(2), 112–124.

Papadakis, S., & Kalogiannakis, M. (2017). Mobile educational games for early childhood: A systematic review. *Educational Technology & Society, 20*(4), 1–13. https://doi.org/10.2307/26229216

Park, H., & Lee, J. (2020). The effects of digital game-based learning on elementary school students' reading and mathematics achievement: Meta-analysis. *Educational Technology Research and Development, 68*(3), 1319–1338. https://doi.org/10.1007/s11423-020-09718-4

Pratiwi, W., & Nugroho, A. (2023). Wordwall sebagai media pembelajaran interaktif untuk anak usia dini. *Jurnal Inovasi Pendidikan Dasar, 7*(1), 34–45.

Putri, D. A., & Hapidin, H. (2023). Game Wordwall sebagai media pembelajaran literasi digital anak usia dini. *Jurnal Ilmiah Potensia, 8*(1), 12–25. https://doi.org/10.33369/jip.8.1.12-25

Rahmawati, F., & Suryana, D. (2022). Efektivitas game edukasi Wordwall dalam meningkatkan kemampuan numerasi anak usia 5-6 tahun. *Jurnal Pendidikan Usia Dini, 16*(1), 45–60. https://doi.org/10.21009/JPUD.161.04

Ribble, M. (2015). *Digital citizenship in schools: Nine elements all students should know* (3rd ed.). International Society for Technology in Education.

Ritonga, D. A., & Gandamana, A. (2023). Pengembangan media pembelajaran game interaktif berbasis web Wordwall pada tema 7 subtema 1 di kelas IV SDN 064966 Kecamatan Medan Perjuangan T.A. 2022/2023. *Jurnal Handayani PGSD Unimed, 14*(2), 53–62. https://doi.org/10.24114/jh.v14i2.45033

Sari, Y. K., & Kurniawan, R. (2021). Pengembangan game edukasi Wordwall untuk meningkatkan kemampuan membaca anak TK. *Jurnal Golden Age, 5*(1), 78–90.

Tan, S. C., & Ng, L. L. (2022). Digital game-based learning for preschoolers: Effects on emergent literacy and numeracy. *Computers & Education, 176*, Article 104356. https://doi.org/10.1016/j.compedu.2021.104356

Wang, C. (2023). Calibration in deep learning: A survey of the state-of-the-art. *Artificial Intelligence Review, 56*(9), 1001–1033. https://doi.org/10.1007/s10462-023-10403-7