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Digital Phonics Ecosystem: Implementation of a Digital Learning Environment to Improve Reading Literacy in Madrasah Ibtidaiyah Students

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Abstract

The development of digital technology demands innovation in reading instruction at Madrasah Ibtidaiyah, as conventional methods often cause students to become bored quickly and lack active engagement. The low reading ability at Madrasah Ibtidaiyah Nurul Mun'im indicates the need for an interactive and contextual digital phonics ecosystem solution. This study aims to describe the implementation of the Digital Phonics Ecosystem assisted by Wordwall media in early reading learning, analyzing its contribution to improving student literacy. The research method used was descriptive qualitative with a case study type, while the data collection techniques included observation of learning activities, interviews with teachers, photo documentation, and early reading tests to measure students' time efficiency and accuracy. The research steps included mapping the initial learning conditions, designing phonics-based Wordwall media, implementation in grade II, and analysis of student learning outcomes. The results showed a significant improvement in early reading skills marked by a decrease in the average reading time from 10 minutes to 6 minutes and all students being able to answer questions correctly. The findings also showed student enthusiasm and collaboration during learning, while the researcher's assistance played a role in ensuring the use of digital media and the teacher's role in adjusting strategies to student abilities. The success of the Digital Phonics Ecosystem depends not only on technology but also on the synergy between teacher guidance and researcher support. This study affirms the potential of the Digital Phonics Ecosystem as an interactive and contextual digital-based phonics learning model to improve reading literacy in Madrasah Ibtidaiyah.

Keywords: *Reading Literacy; Digital Phonics; Wordwall; Madrasah Ibtidaiyah; Learning Ecosystem.*

Abstrak

Perkembangan teknologi digital menuntut inovasi pembelajaran membaca di Madrasah Ibtidaiyah, karena metode konvensional sering membuat siswa cepat bosan dan kurang terlibat aktif. Rendahnya kemampuan membaca di Madrasah Ibtidaiyah Nurul Mun'im menunjukkan perlunya solusi ekosistem fonik digital yang interaktif dan kontekstual. Penelitian ini bertujuan mendeskripsikan implementasi Digital Phonics Ecosystem berbantuan media Wordwall dalam pembelajaran membaca permulaan yang menganalisis kontribusinya terhadap peningkatan literasi siswa. Metode penelitian ini yang digunakan adalah kualitatif deskriptif dengan jenis studi kasus, sedangkan teknik pengumpulan data meliputi observasi kegiatan belajar, wawancara dengan guru, dokumentasi foto, serta tes membaca permulaan untuk mengukur efesiensi waktu dan ketepatan siswa. Langkah penelitian mencakup pemetaan kondisi awal pembelajaran, perancangan media Wordwall berbasis fonik, implementasi di kelas II, serta analisis hasil belajar siswa. Hasil penelitian menunjukkan adanya peningkatan signifikan dalam keterampilan membaca permulaan, ditandai dengan penurunan rata-rata waktu membaca dari 10 menit menjadi 6 menit dan seluruh siswa mampu menjawab soal dengan benar. Temuan juga memperlihatkan antusiasme siswa serta kolaborasi yang muncul selama pembelajaran, sementara pendampingan peneliti berperan dalam memastikan penggunaan media digital dan guru berperan menyesuaikan strategi dengan

kemampuan siswa. Keberhasilan ekosistem fonik digital tidak hanya bergantung pada teknologi, tetapi juga pada sinergi pendampingan guru dan peneliti. Penelitian ini menegaskan potensi Digital Phonics Ecosystem sebagai model pembelajaran fonik berbasis digital yang interaktif dan kontekstual untuk meningkatkan literasi membaca di Madrasah Ibtidaiyah.

Kata Kunci: Literasi Membaca; Fonik Digital; Wordwall; Madrasah Ibtidaiyah; Ekosistem Pembelajaran.

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Introduction

The development of digital technology has brought significant changes to the world of education, including the reading literacy skills of elementary school students. Currently, students live in a digital ecosystem that demands literacy skills that not only include conventional reading abilities but also reading interactive digital texts (Tohet et al., 2021). In Madrasah Ibtidaiyah, reading literacy faces challenges due to the lack of technology integration in early learning. In fact, the use of Digital Phonics media, such as multimedia-based Jolly Phonics, animated videos, and interactive books, has been proven effective in improving the early reading skills of lower-grade students through an interactive approach that adapts to the needs of early childhood (Bali & Rohmah, 2023).

Based on observations conducted at Madrasah Ibtidaiyah Nurul Mun'im, the phenomenon of low early reading skills is also evident in the large number of lower-grade students who are unable to recognize letters, read syllables, or understand simple readings. Teachers still predominantly use textbooks and conventional methods, so students quickly become bored and less actively involved in the learning process. The lack of media innovation and technology integration has resulted in suboptimal reading instruction. Consequently, students' basic literacy development has been slow, which has impacted their other academic abilities. To overcome this, a solution is needed in the form of a digital phonics ecosystem that provides interactive media, visualisation of letter sounds, and digital activities that can increase students' interest and engagement in learning to read (Misuna & BZ, 2025).

Previous studies have shown that interactive media, such as *digital interactive books, flipbooks, educational games,* and *multimedia phonics,* are proven to be effective in improving the reading literacy skills of early grade students. Digital interactive books have a validity score of 96-98% in improving reading skills (Maula & Antara, 2024). Android-based reading applications can improve speed reading skills by combining attractive images, sounds, and animations (Musa & Atqia, 2021). Video and animation-based interactive media can significantly improve early reading skills through the presentation of concrete and easy-to-understand phonics material (Rozi & Paputungan, 2023). In addition, the phonics method effectively improves the reading skills of Madrasah Ibtidaiyah students because it emphasize systematic and repetitive decoding practice (Mupidah et al., 2025).

Furthermore, other studies also confirm that the application of a digital based learning ecosystem in islamic educational environments, including Islamic boarding

schools and madrasah, can increase student engagement while strengthening the integration of islamic values in the learning process (Islamy & Ramadani, 2025). The implementation of ICT-based media has also been proven to support more flexible distance learning (Wanglang & Chatwattana, 2023). Various studies indicate that interactive media have a positive impact on improving early literacy because they provide stronger visual and audio stimuli compared to conventional methods (Imjai et al., 2024). However, most of these studies still focus on the development of one type digital media. Rather than on the design of an integrated digital learning environment.

Criticism of previous research also needs to be emphasized. For example, the research by Musa and Atqia only emphasized reading speed, not reading comprehension, so it was less relevant to the context of early literacy in Madrasah Ibtidaiyah. Similarly, the research by Rozi and Paputungan wa conducted in public schools, so it did not describe the specific needs of madrasahs. This gap highlights the need for a more comprehensive and contextual digital ecosystem model.

These local findings align with the international literature. Adnyana's research demonstrates that digital phonics media based on stories and songs effectively support early reading skills in multicultural schools (Adnyana et al., 2023). Other international literature findings, through a systematic review, confirm that phonics instruction plays a crucial role in improving reading accuracy in early childhood (Torgerson et al., 2006). Furthermore, 21st-century literacy demands the integration of technology and critical practices in learning, making the development of a digital phonics ecosystem increasingly relevant (Mirra & Garcia, 2021).

This research gap opens up opportunities to introduce a Digital Phonics Ecosystem, which is a digital based phonics learning ecosystem that combines applications, videos, phoneme audio, syllable exercise, gamification, and teacher student interaction in one unit. This study aims to describe the implementation of a digital phonics ecosystem in early reading learning at Madrasah Ibtidaiyah Nurul Mun'im and analyze its contribution to improving students' reading literacy. Specifically, this study seeks to explain how the integration of information and communication technology can strengthen the phonics learning process through interactive digital media.

This study focuses on: (1) mapping the learning conditions before the application of the digital ecosystem, (2) the design and implementation process, and (3) the impact on the reading abilities of Madrasah Ibtidaiyah students. This is in line with findings that the development of information technology has brought about major transformations in the world of education, enabling the learning process to be more flexible, unrestricted by time and space, and providing easy access to various learning resources (Bali, 2019).

Conceptually,this study is based on the argument that the integration of digital media in the phonics learning process can strengthen students' early reading skills through the presentation of material that is more concrete, interesting, and easy to understand. A digital ecosystem that combines letter sound audio, phonics animation videos, interactive reading applications, and gamified syllable exercises is believed to be able to significantly increase

students' interest in learning, focus, and motivation. Various studies show that interactive media has a positive impact on early literacy improvement because it provides stronger visual and audio stimuli than conventional methods (Andrianu et al., 2025; Hartutik & Aprilia, 2024; Sari et al., 2024). Therefore, this hypothesizes that *the Digital Phonics Ecosystem* will make a real contribution to improving the decoding, word recognition, and reading fluency of students at Madrasah Ibtidaiyah Nurul Mun'im. The implication of this study is the availability of a digital-based phonics learning model that can be replicated and adopted by other madrasahs to strengthen reading literacy.

METHODS

This section explains how the research was carried out, which includes research designs, populations, and samples (research targets), research procedure, data collection techniques, and data analysis techniques. For qualitative research such as classroom action research, case studies, and so on, it is necessary to add the presence of researchers, research subjects, informants who helped, along with ways to explore research data, location, and duration of research, as well as a description of checking the validity of research results. The method used must be accompanied by a reference, and relevant modifications must be explained. The procedure and data analysis techniques must be emphasized in the literature review article. The stages and analysis of the research must be explained in detail. The research method must be written in paragraph form.

This research used a descriptive qualitative approach with a case study type. A qualitative approach was chosen because this study aims to describe in depth the reading learning process through the application *of the phonics method* and to understand the actual conditions in the field. A descriptive type of research was used to describe the phenomenon of reading learning that took place without providing a special experimental treatment. This research was conducted at Madrasah Ibtidaiyah Nurul Mun'im, located in Karanganyar Village, Paiton District, Probolinggo Regency. The research was conducted in the even semester (II) of the 2025/2026 academic year. The selection of the research location was based on the consideration that the madrasah had a beginner reading learning program and was willing to be the venue for the research.

The subjects in this study were the homeroom teachers of the second grade at Madrasah Ibtidaiyah Nurul Mun'im. Teachers were chosen as the research subject; they played a direct role in the implementation of reading lessons, while students were chosen to obtain data on student responses and reading abilities during the learning process. Data collection techniques in this study were conducted through observation, interview, and documentation. Observations were made to directly observe the reading learning process through the application *of the phonics method* and student involvement during the learning process. Interviews were conducted with class teachers to obtain in-depth information about the implementation of reading learning and the obstacles encountered. Documentation was used as supporting data in the form of students' Wordwall exercise results. Data analysis in this study was carried out through the stages of data reduction, data presentation, and conclusion drawing. The data obtained from observation,

interviews, and documentation were analyzed descriptively to describe the phenomenon of digital phonics learning at Madrasah Ibtidaiyah Nurul Mun'im. This study did not use statistical analysis but emphasized an in depth understanding of the process and meaning of the words concluded. The validity of the data in this study was carried out using Technical Triangulation, which is comparing data obtained from observation, interviews, and documentation to ensure the accuracy of the research data.

Results

The initial reading test indicated an improvement in reading efficiency. Before the implementation of the Digital Phonics Ecosystem, the average reading time for students was 10 minutes, whereas after the implementation of the WordWall medium, it decreased to 6 minutes. All students correctly answered 15 questions on letter and simple word recognition. These results should be understood within the context of the instrument's difficulty level, which was indeed tailored to the foundational abilities of second-grade students.

Based on the results of research conducted at Madrasah Ibtidaiyah Nurul Mun'im, reading learning using the phonics method is carried out by emphasizing the recognition of letter sounds before students read whole words. Learning activities begin with the introduction of vowel and consonant sounds through pronunciation together, then continue with exercises combining letter sounds into syllables or simple words.

During the learning process, the teacher used interactive media in the form of Wordwall games as a means of practising and evaluating students' reading skills. The use of Wordwall aimed to increase students' interest in learning and help them recognize letter sounds and read simple words in a more enjoyable atmosphere. During the activity, the students appeared enthusiastic and actively followed the instructions given.

The results of the Wordwall activity showed that all students were able to complete the questions given with a good level of accuracy. However, based on the observation results, there was interaction between students during the activity, such as looking at each other's answers and discussing with peers. This condition shows that there is a collaborative learning process that occurs naturally in the classroom, in line with social learning theory, which emphasises the importance of interaction in building understanding.

The findings of this study indicate that the application of the phonics method assisted by Wordwall media is effective in supporting letter recognition in second-grade students at Madrasah Ibtidaiyah Nurul Mun'im. Before using Wordwall, students needed an average of about 10 minutes to read simple texts. After practising with Wordwall media, the average reading time decreased to 6 minutes, indicating an increase in efficiency in the initial reading process.

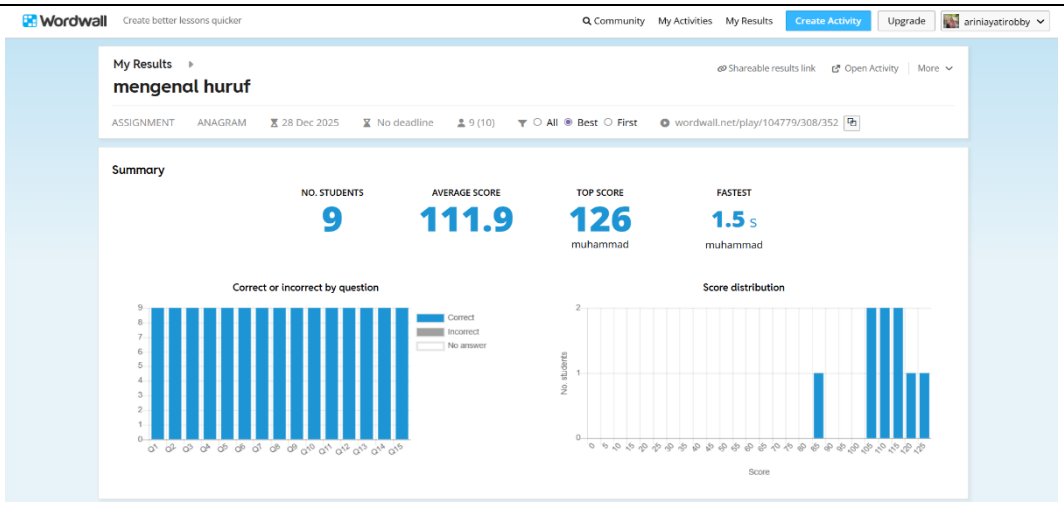

Figure 1. Graph of Wordwall Exercise Results for Grade II Students at MI Nurul Mun'im

As shown in Figure 1, all students answered 15 questions correctly, with no wrong answers. The average score obtained was 111.9, with the highest score being 126 and the lowest score being 88. The score distribution shows that most students scored between 105 and 125, confirming that students have been able to recognize letters and simple words well.

Figure 2. Second Grade Students at MI Nurul Mun'im using Wordwall in Digital Phonics Lessons

The documentation shows the active involvement of students in using digital media. Their enthusiasm supports the finding that Wordwall is able to create a fun and interactive learning atmosphere. In addition to assistance from researchers, classroom teachers also played an active role in guiding students during the activity. Teachers provided direction, ensured that students understood the instructions, and helped students who experienced difficulties.

Figure 3. The Classroom Teacher Assists Students in Reading Practice using Wordwall

The above documentation shows the role of teachers as facilitators in digital phonics learning. The presence of teachers remains crucial in adjusting learning strategies to the diverse abilities of students. This is in line with the view on the importance of adult support in children's cognitive development stages. With the guidance of teachers, students who experience difficulties can remain actively involved in activities, thereby optimizing the effectiveness of digital media. The findings of this study confirm that the digital phonics ecosystem not only depends on technology but also on human interaction that supports the learning process.

Table 1. Results of Each Student's Wordwall Assignment

Results by student

SORT BY ◉ Submission ○ Name ○ Correct + Time

Student	Submitted	Score	Correct	Incorrect	Time
said ahmad mustofa	9:21 - 28 Dec 2025	114	15	0	5:56
ahmad mudarik zaini	9:22 - 28 Dec 2025	105	15	0	7:28
muhammad	9:26 - 28 Dec 2025	126	15	0	3:05
abdul rouf	9:27 - 28 Dec 2025	111	15	0	4:19
muhammad imdadur rohman romadhoni	9:33 - 28 Dec 2025	108	15	0	6:02
asmaul jannah	9:46 - 28 Dec 2025	115	15	0	8:04
Laila qonita farihah	9:54 - 28 Dec 2025	123	15	0	6:14
Naura zahra agustin	10:03 - 28 Dec 2025	117	15	0	6:16
Adiba qutrun nada	10:11 - 28 Dec 2025	88	15	0	5:37

The data in table 1 shows variations in scores and completion times among students. Although all students answered correctly, there were differemces in completion speed.

Some students were able to complete the questions quickly, while others needed more time and teacher guidance.

Table 2. Wordwall Results Per Question

Results by question SORT BY ◉ Number ○ Correct ○ Incorrect

	Question	Correct	Incorrect
1	Sapi	9	0
2	Kuda	9	0
3	Ayam	9	0
4	Semut	9	0
5	Anjing	9	0
6	Monyet	9	0
7	Kambing	9	0
8	Rusa	9	0
9	Gajah	9	0
10	Daun	9	0
11	Bola	9	0
12	Buku	9	0
13	Buah	9	0
14	Pensil	9	0
15	Pintu	9	0

Table 2 shows that all students answered correctly on every question (Q1-Q15), this reinforces the effectiveness of the Wordwall-assisted phonics method in introducing letters and simple words interactively.

Overall, the results of this study indicate that the application of the phonics method assisted by Wordwall media can significantly improve students' letter recognition skills. This is demonstrated by quantitative achievements in the form of a decrease in the average reading time from 10 minutes to 6 minutes, and the success is reinforced by observation results that show collaborative interaction between students during the activity. Thus, Wordwall is not only effective in accelerating the letter recognition process, but also contributes to the creation of an interactive and enjoyable learning environment in the classroom.

Discussion

The results of the study indicate that the application of the phonics method using Wordwall media can increase student engagement in reading learning. The reduction in average reading time from 10 minutes to 6 minutes demonstrates that interactive digital media can accelerate the process of recognising letters and simple words. The enthusiasm and confidence of students in completing the exercises show that interactive digital media can be an effective tool to support reading literacy in Madrasah Ibtidaiyah. The claim that all students answered correctly on the test must be understood within the context of the instrument's difficulty level, which aligns with the foundational abilities of second-grade students. These findings are consistent with the research (Salamah et al., 2018) which confirms the effectiveness of the phonics method in training early reading skills in young children. Thus, a 100% correct score is more appropriately interpreted as evidence of

WordWall's success in supporting basic letter recognition, not as an indicator of full mastery of reading literacy.

The phonics method emphasizes the recognition of letter sounds before reading whole words. This is in line with the theory of early literacy, which emphasizes the phonemic stage as the basis of reading skills (Wahid et al., 2020). Digitization through Wordwall reinforces this stage with interactivity and gamification, so that students are more motivated to learn. Teachers' strategies in developing early reading skills through the phonics method are also confirmed by Rohma, who shows that the phonemic approach helps children recognize letters more quickly (Rohma, 2024). Similarly, Waluyo emphasizes that the application of phonics in early childhood education literature is effective in accelerating early reading mastery (Waluyo et al., 2024). The application of phonics in early childhood education has also proven effective in accelerating the acquisition of early reading skills. This study adds a new dimension in the form of digitalization through WordWall, thereby expanding the context of phonics application to the Madrasah Ibtidaiyah environment.

Observations show that there is collaboration between students during the activity. This condition is in line with social learning theory, which emphasizes the importance of observation and interaction in the learning process (Agus R et al., 2022). The collaboration that arises naturally shows that digital media not only functions as individual tool but can also foster students' social skills. Berlingrum's research also shows that Wordwall can foster social interaction and learning focus among elementary school students (Berliningrum et al., 2025). Thus, WordWall functions not only as an individual learning tool but also as a collaborative medium that strengthens students' social skills.

Fitrianti's research results show that the use of Wordwall-based media can improve elementary school students' reading comprehension skills, as indicated by an increase in reading comprehension test scores after the intervention (Fitrianti et al., 2025). These findings are consistent with research at SD Muhammadiyah Kutoarjo, which shows that Wordwall helps students recognize letters, sounds, and simple words more quickly (Yulianti et al., 2025). Habibah, through a *Systematic Literature Review,* found that Madrasah Ibtidaiyah teachers face major challenges in integrating digital literacy into the independent curriculum, such as limited digital competence of teachers, lack of technological facilities, and the need for continuous training (Habibah et al., 2025). The SLR results confirm that the success of digital literacy in Madrasah Ibtidaiyah is highly dependent on teacher readiness and school policy support. Indriani also shows that Wordwall can be developed as an educational game-based digital assessment (Indriani et al., 2025). Compared to these studies, this research not only confirms the effectiveness of Wordwall in improving reading skills. It also expands the context of its application to Madrasah Ibtidaiyah with a focus on student engagement, reading time efficiency, and social interactions that arise during activities. This study provides new evidence that Wordwall can function as a fun digital phonics learning medium while also building collaboration among students in the madrasah environment.

The practical implications of this study are that Madrasah Ibtidaiyah teachers can utilize Wordwall as a fun learning medium for reading as well as a digital assessment tool. Oktavia's research confirms that Wordwall can increase learning motivation through educational games while also creating a fun, engaging learning experience for students (Oktavia et al., 2025). However, this study also found that some students needed more time and guidance from teachers. This condition shows that even though digital media is effective, the role of teachers remains crucial in assisting students with diverse abilities. This is in line with Piaget's view of the stages of children's cognitive development, where teacher support is needed to adjust learning strategies to the level of student development (Piaget & Inhelder, 2008). Khotima's research confirms that the phonics approach has been proven to improve the reading skills of early childhood, making it relevant for further development in madrasahs (Khotimah et al., 2023). Further research could examine the role of the digital phonics ecosystem in other madrasahs with a larger sample size, or develop a more interactive digital phonics application that is integrated with the local culture.

The assistance provided by researchers during the activities showed that students were able to understand the use of digital media more quickly because of direct guidance on the technical aspects of Wordwall. This shows that the presence of researchers served as facilitators of innovation, ensuring that new media could be used correctly by students. However, teacher assistance has a different role. Teachers not only assist with the technical use of media but also adjust learning strategies to meet the diverse abilities of students. Teachers understand the characteristics of each child, so they can provide personal support according to their cognitive development stage.

This difference in roles confirms that the success of the digital phonics ecosystem does not only depend on technology, but also on the synergy between researcher innovation and teacher assistance. Researchers act as developers and testers of media, while teachers act as facilitators who integrate media into the classroom context. These findings reinforce Piaget's view that adult support is necessary to adapt learning strategies to children's developmental stages. In addition, these results also expand on the research of Berliningrum and Habibah, which emphasize the effectiveness of Wordwall, by adding an important dimension: the success of digital media is greatly influenced by the quality of classroom teacher guidance.

Conclusion

This study proves that the application of the Digital Phonics Ecosystem with the support of Wordwall media is effective in improving the early reading skills of second-grade students at Madrasah Ibtidaiyah Nurul Mun'im. The data shows an increase in reading efficiency, marked by a decrease in the average reading time from 10 minutes to 6 minutes, as well as the success of all students in answering questions correctly. Documentation of activities also shows the active involvement and enthusiasm of students during the learning process, both when accompanied by researchers and teachers.

A synthesis of the results confirms that the success of the digital phonics ecosystem depends not only on technology but also on the synergy between teacher guidance and researcher support. The researcher's role focused on ensuring that digital media was used optimally, while the teacher's role was to adjust the learning strategy to the diverse abilities of the students. The synergy between the two confirms that the success of the digital phonics ecosystem does not solely depend on technology but also on human interaction that supports the learning process. Thus, this study offers a new contribution in the form of evidence that the WordWall can function as an engaging digital phonics medium while fostering collaboration among students in a madrasah setting.

However, this study has limitations: the sample size is relatively small (10 students) and was conducted at only one madrasah, so the results cannot be widely generalized. The test instruments also focused more on letter and simple word recognition, without measuring deeper aspects of reading comprehension.

Future research could include testing the Digital Phonics Ecosystem in other madrasahs with a larger sample size, developing more interactive digital phonics applications integrated with local culture, and measuring reading comprehension aspects to obtain a more comprehensive picture of student literacy.

Academically, this study expands the study of Wordwall's effectiveness by adding an important dimension, namely the integration of digital media in the context of Madrasah Ibtidaiyah and the role of teacher assistance as a determining factor for success. The practical implication is that MI teachers can use Wordwall as a fun learning and digital assessment medium, while still assisting in accordance with the students' cognitive development stages.

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