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Enhancing fifth-grade reading skills through RADEC and QuizWhizzer

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Abstract. Reading ability remains a major issue in Indonesian primary schools, as reflected in students' low performance on global literacy assessments. This issue is frequently related to teacher-centered education and insufficient utilization of engaging digital learning resources. This study examines the effect of integrating the RADEC learning model with the QuizWhizzer platform on fifth-grade students' reading comprehension. The research population comprised fifth-grade children at SDN Tengah 07 Jakarta, and saturation sampling was used, with all students serving as research participants and separated into an experimental and control group. Pretests and posttests were administered using multiple-choice reading comprehension test instruments that included literal, inferential, critical, and creative features. Due to non-normal data distribution, the Wilcoxon signed-rank test was applied for analysis. The findings indicate improvement in both groups, with significantly greater gains in the experimental group. These findings demonstrate the usefulness of integrating structured learning models with interactive digital media in increasing engagement and understanding through active involvement and collaboration. Future research should investigate larger samples and longer implementation periods, as well as the incorporation of comparable digital platforms, to increase reading instruction in elementary school.

Introduction

Several studies have shown that early childhood language skills significantly impact the later development of reading skills (Reikerås & Dahle, 2022). Reading skills form an essential foundation for students' intellectual development and academic success at various levels. Reading is not limited to recognizing letters and words, but also encompasses the ability to understand, evaluate, and reflect on text content. Teaching reading is often viewed as the primary responsibility of elementary school teachers, particularly in the early years of formal education (Colognesi et al., 2023). However, reading skills must be continuously developed and should not be limited to the early school years so that students can achieve more complex levels of comprehension.

Real-world experiences from many months of School Field Introduction served as the basis for this study. According to observation, some pupils still struggle to understand writing that goes beyond the literal level. Students' capacity to evaluate and analyze texts is hampered by their tendency to concentrate on reading aloud during class activities rather than creating meaning. Additionally, teacher explanations often predominate in learning activities, with little student input, leading to low engagement and passive learning. The low reading proficiency of elementary school students in Indonesia is influenced by internal and external factors. Linguistic support from

teachers, such as using rich vocabulary, open-ended questions, and elaborating on children's utterances, plays a crucial role in students' language and literacy development (Haen et al., 2026).

The results of the 2022 PISA international student assessment showed that Indonesian students' reading proficiency stood at 359 points, a decline from 371 points in 2018; Indonesia thus ranked 71st out of 81 countries (OECD, 2023). Furthermore, the quality of children's written narratives aged 8 to 11 is influenced by the reading and writing environment at home, particularly by the frequency and quality of informal reading and writing activities, such as shared reading and story discussions (Song et al., 2025; Jaya et al., 2026). Reading is often perceived as merely reading aloud a sequence of words in a text, whereas its essence lies in understanding, interpreting, and constructing meaning from texts. This reality limits students' access to information, their understanding of learning content across various subjects, and their development of higher-order thinking skills. The quality of reading instruction must be designed to help students fully understand the content and meaning of texts. Therefore, reading instruction should provide students with opportunities to develop a variety of skills (Mulatu & Regassa, 2022).

In today's digital era, integrating learning technology is essential to increase student engagement and motivation (Widana & Ratnaya, 2021). Increasing reading interest from low to high levels provides a strong affective foundation, in which students who feel happy, interested, and engaged are more likely to read, repeat practice questions, and review texts to find the correct answers (Liandri et al., 2024). By leveraging the potential of digital media, technology in learning can be positioned as a strategic opportunity to deliver more meaningful, contextual learning experiences (Obojska & Vaiouli, 2025). This collaborative and connected learning environment enables the integration of technology, opening opportunities to create valuable learning experiences.

This statement suggests that reading literacy in primary school is more than just the technical capacity to recognize words; it also encompasses the ability to understand, evaluate, and critically reflect on the substance of what is read (Sartika et al., 2025). Furthermore, incorporating digital tools into the classroom has been shown to be an effective way to enhance student motivation and engagement while supporting a context-based learning experience. This study investigates the efficacy of the RADEC model in conjunction with the QuizWhizzer application in enhancing fifth-grade students' reading skills. More specifically, this study aims to assess the extent to which integrating the model and digital media can strengthen reading comprehension, increase learning engagement, and support the creation of a learning process that meets the requirements for literacy and 21st-century skills.

The paradigm shift in 21st-century education calls for a learning process focused on developing critical thinking, creativity, collaboration, and communication skills (Widana et al., 2020). However, learning practices in elementary schools continue to be dominated by conventional methods such as lecture-style teaching and rote memorization. This teacher-centered learning model tends to position students as passive recipients of information, leaving little room for exploration, discussion, or independent understanding. This situation poses a major challenge for Indonesian language instruction in elementary schools, particularly in developing reading comprehension skills, which require higher-order thinking processes.

The limited variety of learning media also contributes to low student motivation. Intrinsic and extrinsic motivation play a crucial role in the success of the learning process, particularly at the elementary school level. Research on gamification in the learning process shows that integrating game elements such as scores, challenges, and immediate feedback can significantly increase engagement and learning outcomes compared to traditional approaches (Zainuddin et al., 2020). However, the implementation of digital media in elementary schools remains limited to static

presentations or simple worksheets, thereby underutilizing technology's potential as a meaningful learning tool.

In light of these challenges, a new learning model is needed to improve elementary school students' reading skills in a structured, sustainable way. The RADEC model (Read, Answer, Discuss, Explain, and Create) has proven to be highly effective in improving elementary students' science literacy. This is achieved through phases of text-based reading and discussion that promote active participation and center the learning process on the students (Salma Ihsani Fhilrizki et al., 2024). In addition to its impact on academic aspects, the implementation of RADEC through systematic reading and writing activities and discussions also contributes to personal development, for example, by fostering responsibility, collaboration, discipline, creativity, and self-confidence (Suryana et al., 2025). This approach aligns with constructivist theory, which emphasizes the construction of knowledge through social interaction and direct experience. Research from the "Play for Learning" project shows that the transition from teacher-centered learning to a student-centered, play-based pedagogy has positive effects on behavior, social interactions, and literacy skills, including oral language proficiency and early literacy skills (Bird et al., 2025). However, most earlier research has focused on the RADEC model's use in scientific learning, with little emphasis on its use in Indonesian language education, particularly in strengthening reading comprehension abilities at the basic level. Digital media such as QuizWhizzer can be used as a game-based evaluation tool that requires students to read questions, answer choices, and explanatory text quickly and carefully, thus encouraging intensive reading practice in a fun atmosphere. This platform can package Higher Order Thinking Skills (HOTS)-based questions into an interactive quiz format accessible on digital devices. Its advantages include an automated scoring system, engaging visuals, video integration as a learning stimulus, and a ranking feature that encourages healthy competition and increases student motivation (Kumala et al., 2024). With these characteristics, QuizWhizzer has the potential to support the strengthening of reading skills while actively engaging students in the evaluation process.

This study underscores the importance of RADEC for elementary school students' reading comprehension skills, as the RADEC model (Read, Answer, Discuss, Explain, Create) encourages students to read actively, answer questions, discuss, explain, and create summaries, thereby overcoming the monotony of traditional lecture-based teaching methods (Ulfa et al., 2024). In the context of the research under investigation, these findings provide a solid basis for concluding that RADEC successfully improves independent reading comprehension by integrating QuizWhizzer as an interactive medium during the response phase, thereby optimizing student engagement, as recommended for Indonesian language instruction in elementary school. A study by Uliana Hidayatika & Didah Nurhamidah (2024) demonstrated that using QuizWhizzer as an innovative assessment tool can increase student engagement and learning outcomes in Indonesian language classes. This tool combines game and learning elements, thereby creating an entertaining learning atmosphere without neglecting the academic core. Although QuizWhizzer has been shown to improve student engagement and learning results, its use in literacy education using organized learning models such as RADEC has received little attention. Thus, this study makes a unique contribution by combining the RADEC model with QuizWhizzer in the context of Indonesian language learning, especially to improve primary students' reading comprehension through a mix of organized learning stages and gamified digital media.

Based on the preceding information, the research problem may be stated as follows: (1) Does integrating the RADEC paradigm with QuizWhizzer improve students' reading comprehension? (2) How much does this integration increase students' comprehension skills compared to traditional learning? As a result, the hypothesis of this study is that combining the RADEC model with QuizWhizzer has a considerable favorable impact on students' reading comprehension. Thus, the

purpose of this study is to investigate the efficacy of combining the RADEC learning paradigm with QuizWhizzer in increasing fifth-grade students' reading comprehension skills.

Method

Research Design & Participants

This study employs a quantitative, quasi-experimental approach to investigate the effectiveness of the RADEC learning model, supported by the QuizWhizzer app, in improving the reading skills of Year 5 primary school pupils. A quantitative design is appropriate, as this study focuses on measuring the effects of the intervention. The quasi-experimental design was chosen because random allocation of participants was not possible, as the classes in the primary school had already been formed and their composition could not be altered. In particular, this study employs a non-equivalent control group design comprising two groups: an experimental group and a control group without random allocation. Both groups were assessed using pre- and post-tests to determine changes in the pupils' reading skills following the intervention (Agustina et al., 2024)

Table 1. Nonquivalent Control Group Design Model.

Group	Pre-Test	Treatment	Post-Test
Experiment	O1	X	O2
Control	O3		O4

In this study, the population was categorized into two types: the target population and the accessible population. The target population consists of all fifth-grade students at SDN Tengah 07 who are learning Indonesian based on the self-directed curriculum. Meanwhile, the accessible population comprises all fifth-grade students at the same school during the second semester of the 2025/2026 academic year, totaling 52 students across two parallel classes, namely Class VA and Class VB. A sample refers to a portion of the population that represents the group as a whole (Abubakar, 2021). A total sampling technique (saturated sampling) was employed, in which all members of the accessible population were included as the research sample. Consequently, the entire population was selected with Class VA assigned as the experimental group and Class VB as the control group.

Research Instrument

The primary instrument used in this study was a reading test administered in two phases: a pretest and a posttest. The pretest was administered before the intervention to measure students' initial reading ability, while the posttest was administered after the intervention to assess changes or improvements that occurred during the learning process. Since both tests used the same instrument, a comparison of the results provides a clear picture of the students' progress.

Before implementation, the instrument underwent expert validation to ensure that each item aligned with the intended reading skill indicators. Following this stage, a pilot test was conducted with respondents outside the research sample to evaluate the instrument's quality, including its difficulty level, discriminative index, and clarity. The data obtained from the pilot test were then analyzed to assess item validity, ensuring that the instrument accurately measures the construct intended in the study.

The ability to read Indonesian narrative texts in the 5th grade of elementary school is operationally defined as students' ability to engage in reading activities and comprehend narrative texts by providing a series of answers to reading comprehension tasks and questions. Reading levels in elementary school are divided into two parts: beginner reading for lower grades and advanced reading for higher grades; the latter is referred to as reading comprehension (Rahmi & Marnola,

2020). Reading comprehension is the process of understanding the content of a text, which reflects the author's thoughts, ideas, reflections, and opinions (Rifa & Chandra, 2025). From the perspective of proficiency levels, reading comprehension consists of four stages, namely (1) literal reading comprehension; (2) inferential reading comprehension; (3) critical reading comprehension; and (4) creative reading comprehension (Kholiq & Luthfiyati, 2020).

Table 2. Instrument Grid

Reading Comprehension Level	Focus	Indicator
Literal	Finding information written directly in the story.	Identifying characters. Describe the character's activities in the story. Finding factual information without interpreting.
Inferential	Interpret messages, reasons, or changes in attitude based on clues in the story.	Summarize the message the character conveys. Explaining the reasons for the character's actions. Identifying changes in attitude based on the storyline.
Critical	Assess, evaluate, and determine the value or meaning of the story.	Determine the conclusion according to the story. Assess the main moral message of the story. Distinguish between logical and illogical answers.
Creative	Develop attitudes, solutions, or actions based on understanding the story.	Determine an attitude to emulate. Design actions that should be taken. Provide solutions to prevent problems.

Treatment Procedure

The research was done in three sessions. The first session included a pretest to assess pupils' initial reading abilities using the same instrument as the posttest. The second session involved implementing treatment in the experimental class using the RADEC stages: students read the text independently (Read), took a QuizWhizzer quiz (Answer), participated in group discussions (Discuss), presented their findings (Explain), and created a short story based on personal experience (Create). Meanwhile, the control class was instructed by the classroom teacher using normal methods. In the third session, a posttest was given using the same instrument to examine changes in students' reading abilities. The treatment's effect was determined by analyzing the pretest and posttest data.

Data Analysis Techniques

Data analysis in this study was systematic and sequential, in accordance with the research objectives and the nature of the data collected. The first stage involved descriptive statistical analysis of the pre-test and post-test outcomes in the experimental and control groups. This procedure involved calculating the mean, standard deviation, and range of values (minimum and maximum). This study provided a basic understanding of the data distribution before moving on to more complex processes.

The following step evaluated requirements using a normality test to determine whether the data in each group were normally distributed. The Shapiro-Wilk test was used due to the small sample size (less than 50 participants per group), since it is thought to be more sensitive and suitable under these conditions than the Kolmogorov-Smirnov test. The significance value serves as the basis for

interpretation: a value greater than 0.05 indicates a normal distribution, whereas a value less than 0.05 indicates the reverse.

The last step involved hypothesis testing to determine whether there was a significant difference in students' reading comprehension skills before and after the intervention. Because the premise of normality was not fully fulfilled, the Wilcoxon Signed-Rank Test, a nonparametric alternative, was applied. This test is especially appropriate for paired data, such as pre-test and post-test scores, because it examines both the direction and size of change. Thus, using this test increases the validity of the conclusions, as it accommodates non-normal data more reliably than parametric approaches. The decision criterion is that if the Asymp. Sig. (2-tailed) value is less than 0.05, the null hypothesis (H_0) is rejected, suggesting a statistically significant difference between the two score sets.

Results and Discussion

The study's data analysis findings are presented in this section, along with a discussion. The pretest and posttest results administered to students in the experimental and control groups provided the data for the analysis. An overview of the pupils' reading skills, both before and after the therapy, was obtained through the analysis. To evaluate the overall state of the study findings, the data were first presented descriptively. This was followed by statistical analysis to identify any variations or enhancements in the students' reading skills following the implementation of the curriculum. The analysis's findings were then evaluated to clarify how the study's treatment affected the pupils' reading skills.

Table 3. Descriptive Analysis of Pretest and Posttest

Calculation Type	Group			
	Experiment Pretest	Experiment Posttest	Pretest Control	Posttest Control
Mean	61.54	83.08	62.69	71.15
Standard Deviation	17.133	14.359	19.091	16.572
Minimum	30	40	30	40
Maximum	90	100	90	100
A lot of data	26	26	26	26

The descriptive statistics in the table reveal that each group included 26 students with no missing data. The pre-test mean score for the experimental group was 61.54, with a range of 30 to 90. The mean posttest score, which ranged from 40 to 100, increased considerably to 83.08 once the learning intervention was implemented. Students' reading comprehension increased dramatically following the learning intervention, as evidenced by a large increase in the mean score.

In the control group, the mean score increased from 62.69 on the pretest to 71.15 on the posttest, both within a comparable scoring range. However, the improvement was smaller than that reported in the experimental group, indicating that traditional training contributed to advancement, albeit less effectively than the intervention.

Image 1. Students working on questions in QuizWhizzer

Additionally, from 17.133 in the pre-test to 14.358 in the post-test, the standard deviation values show a decrease in score variance within the experimental group. This decline suggests that following the intervention, student achievement was spread more fairly. The control group likewise showed a similar trend, with the standard deviation falling from 19.093 to 16.572. Overall, these descriptive data show that learning outcomes improved for both groups, with the experimental group's gains more pronounced following the intervention.

Normality testing was also performed using statistical analysis tools to evaluate data distribution. The results yielded significance values below 0.05, suggesting that the data were not normally distributed and justifying the use of non-parametric statistical tests for subsequent research. This preliminary test is critical because it ensures that appropriate statistical methods are used in future analysis, improving the accuracy and reliability of the study results.

Table 4. Shapiro Wilk Normality Test

Group	Statistics	Df	Sig.
Experiment Pretest	.941	26	.141
Experiment Posttest	.886	26	.008
Pretest Control	.918	26	.041
Posttest Control	.930	26	.077

The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to evaluate the normality of the pretest and posttest data from both the experimental and control groups. The Shapiro-Wilk test revealed that the experimental group's pretest data were normally distributed ($p = 0.141 > 0.05$), while the posttest data were not ($p = 0.008 < 0.05$). The control group's pretest data were non-normally distributed ($p = 0.041 < 0.05$), whereas the posttest data were normally distributed ($p = 0.077 > 0.05$). The results show that the assumption of normality was not consistently satisfied across all datasets. As a result, parametric statistical tests were judged unsuitable for further study. As a consequence, a non-parametric test, namely the Wilcoxon signed-rank test, was used to compare pretest and posttest findings within each group, confirming the validity of the study despite breaches of normality assumptions.

Table 5. Analysis of Results Using the Wilcoxon Test

Group		N	Mean Rank	Sum of Ranks
Posttest-Pretest Experiment	Negative Ranks	0 [a]	.00	.00
	Positive Ranks	23 [b]	12.00	276.00
	Ties	3 [c]		
	Total	26		
Posttest-Pretest Control	Negative Ranks	0 [d]	.00	.00
	Positive Ranks	15 [e]	8.00	120.00
	Ties	11 [f]		
	Total	26		

a. Experimental Post Test < Experimental Pre Test
b. Experiment Post Test > Experiment Pre Test
c. Post Test Experiment = Pre Test Experiment
d. Post Test Control < Pre Test Control
e. Post Control Test > Pre Control Test
f. Post Control Test = Pre Control Test

The Wilcoxon Signed Rank Test results indicate that the pre-test and post-test scores in both research groups differ considerably. Of the 26 students in the experimental group, 23 (88.5%) observed an increase in scores after receiving therapy (positive rankings), 3 had scores that were constant (ties), and none had a decrease in scores. This is evidenced by a mean rank of 12.00 and a sum of ranks of 276.00, indicating that the experimental group's therapy was consistently effective in improving student learning outcomes.

Image 2. Showing student rankings

Meanwhile, in the control group, 15 students (57.7%) had higher grades (positive rankings), 11 students had the same grades (ties), and no students had worse marks (negative ranks = 0). The control group's mean rank was 8.00, with a total of 120.00 ranks, suggesting a smaller increase than in the experimental group.

A comparison between the two groups showed that the experimental group had a greater number of positive ranks (23 vs. 15), a higher mean rank (12.00 vs. 8.00), and a significantly larger sum of ranks (276.00 vs. 120.00). This condition indicates that the increase in learning outcomes in the experimental group was greater and more evenly distributed than in the control group. Thus, it can be concluded that the treatment given to the experimental group was more effective in improving student learning outcomes than conventional learning in the control group.

Table 6. Test Statistics Wilcoxon Test

	Post Test – Pre Test Experiment	Post Test – Pre Test Control
Z	-4.230 [b]	-3.531 [b]
Asymp.Sig.(2 tailed)	<.001	<.001

Table 6 shows that the significant value for the experimental and control classes was <0.001, which is less than 0.05. This shows a considerable difference between the pretest and posttest results. Thus, the alternative hypothesis (H_a), which states that reading ability increases following therapy, is accepted, whereas the null hypothesis (H_0) is rejected. These findings suggest that the learning intervention improves pupils' reading abilities.

Table 7. Analysis of Results Using the Mann-Whitney Test

	Post Test Experiment	Post Test Control
N	26	26
Mean Rank	31.83	21.17
Sum of Ranks	827.50	550.50
Mann-Whitney University	199.500	
Z	-2.588	
Asymp. Sig. (2-tailed)	0.010	

The table reveals that the experimental group considerably improved their reading comprehension compared to the control group. This was confirmed using the Mann-Whitney U test, which compared the posttest outcomes of the two groups. The experimental group received an average rating of 31.83 out of a total of 827.50, whereas the control group received an average rating of 21.17 out of a total of 550.50. This significant difference in average ratings indicates that students in the experimental group performed better on posttests than those in the control group. Further statistical analysis revealed a Mann-Whitney U value of 199.500, a Z score of -2.588, and an Asymptotic Sig. (2-tailed) value of 0.010. The null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted due to the significance value (0.010) being less than the threshold of $\alpha = 0.05$. This shows a statistically significant difference between the two groups' posttest scores following the intervention.

This enhancement may be illustrated through each RADEC stage: the Read phase enhances literal comprehension, and the Support phase supports inferential reasoning by analyzing questions and exchanging ideas. Explain improves critical comprehension by having students defend their replies, whereas Create promotes creative understanding by encouraging students to create new texts. The usage of QuizWhizzer strengthens this process by improving attention, motivation, and rapid feedback via gamified aspects that encourage deeper interaction with the content. Although all groups benefited, most likely owing to exposure to reading activities, the experimental group showed greater gains, indicating that organized and participatory techniques are valuable.

Image 3. Students conducting group discussions

This model is easy to remember and implement, as each phase comprises clear, systematic steps (Lestari et al., 2021). The integration between the stages in the RADEC model makes it relevant for application in various learning contexts, including Indonesian language learning in elementary schools. The RADEC learning model is one that can be implemented to facilitate the formation and strengthening of Pancasila student profiles within the Independent Curriculum (Sutantri et al., 2023). Unlike prior research that used RADEC only in scientific learning contexts, this study expands its use to Indonesian language acquisition, specifically reading comprehension. The findings support the theoretical underpinning of constructivist learning, which emphasizes active involvement and social interaction in building knowledge, as evidenced by the increased comprehension outcomes reported in this study.

This increase in reading ability can be attributed to the learning activities provided, which allow pupils to actively engage in the learning process. Independent reading allows students to absorb the book on their own, whereas group discussions enable students to share their knowledge and clarify the information they have obtained from the reading (Herlina, 2024). It has been shown that this type of collaboration improves reading comprehension, as students can exchange ideas and deepen their understanding of the text content through interaction with their group members (Rajagukguk et al., 2025).

Furthermore, the use of game-based quizzes, such as QuizWhizzer, helps improve student learning outcomes. Digital learning techniques are thought to improve the efficacy of teaching and learning, increase access to learning resources, and make learning more interactive and engaging for students (Fajriatin et al., 2025). Game-based learning media may foster a more engaging, dynamic learning environment, thereby improving students' motivation and engagement throughout the learning process. This influences learning outcomes, as students are more engaged in learning activities (Sawawi & Liesdiani, 2025).

This study is unique in that it combines the RADEC paradigm with QuizWhizzer, a gamified digital media for literacy training. Unlike previous studies that examined these components separately, this study shows how their combination can improve both engagement and reading comprehension in elementary school settings. Reading activities combined with discussion and group work can help students better understand main ideas, make inferences, and interpret information in texts (Wahyurianto & Sylvia, 2024). Based on these findings, teachers should combine organized learning models such as RADEC with interactive digital media to provide more engaging and relevant

reading instruction (Fauziyah & Dari, 2024). Schools are also urged to foster the use of digital platforms that promote active learning and higher-order thinking abilities.

However, this study has significant drawbacks, including a small sample size and a narrow focus on a specific school context, which may limit generalizability. Furthermore, the brief implementation period may fail to reflect the long-term benefits on pupils' literacy development. These restrictions allow future researchers to conduct experiments with larger sample sizes, across different locations, and for longer intervention durations. Theoretically, this study contributes to the constructivist learning paradigm by demonstrating that integrating organized learning stages with gamified digital media can improve reading comprehension. In practice, the findings indicate that integrating RADEC with platforms such as QuizWhizzer may boost student engagement, stimulate active involvement, and support reading skill development in real-world classroom settings.

Conclusion

This study found that combining the RADEC paradigm with QuizWhizzer significantly improved students' reading comprehension, as indicated by a significant increase in mean scores between the pretest and posttest in the experimental class. The RADEC paradigm's structured learning stages, which included independent reading, quiz-based assessment, collaborative discussion, group presentation, and written reflection, combined with the interactive features of QuizWhizzer, resulted in deeper textual understanding and higher-order thinking skills among elementary students, yielding comprehension gains that far exceeded those observed with traditional learning approaches. These findings provide empirical evidence to support the use of technology-enhanced collaborative learning as an effective instructional option for literacy development. In practice, teachers are encouraged to use structured reading frameworks alongside gamified digital tools to maintain student engagement and deepen comprehension, while policymakers should incorporate such integrative approaches into curriculum design and teacher professional development programs, particularly in early literacy education. As a result, it is recommended that teachers combine models like RADEC with interactive platforms to create more engaging literacy learning environments, while policymakers should support the provision of digital infrastructure and training to facilitate the effective implementation of such approaches in primary education.

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