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Enhancing Early Literacy: The Effectiveness of the Picture Word Inductive Model with Smartphone Assistance in the Early Childhood to Elementary Transition

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ABSTRACT

Bridging the learning gap between Early Childhood Education (ECE) and Elementary School (ES) requires an effective transition program. An adaptive learning strategy is crucial to accommodate diverse student profiles and preparation levels. This study examines the effectiveness of the Picture Word Inductive Model with Smartphone Assistance (PWIMSA) in enhancing literacy skills during the ECE-ES transition. A quasi-experimental pretest-posttest control-group design was employed without randomization. The study involved 203 first-grade students from five elementary schools in Bandung, selected through purposive sampling. The schools were chosen based on their adoption of the autonomous curriculum and piloting of the ECE-ES transition program. The experimental group (n = 93) received instruction using the PWIMSA approach, while the control group (n = 110) participated in the school literacy movement program. An independent t-test analysis of gain scores revealed a significant difference in literacy skill improvement between the experimental and control groups (significance value < α). The experimental group demonstrated an average gain of 6.92 points higher than the control group, indicating that PWIMSA is more effective in enhancing foundational reading skills. The findings suggest that PWIMSA supports literacy development by accommodating diverse student abilities and learning needs. Its integration into transition programs can bridge early education gaps and foster stronger literacy foundations. PWIMSA is an effective instructional approach for improving literacy skills in the ECE-ES transition program, addressing student diversity and enhancing foundational reading abilities.

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1. INTRODUCTION

The transition from Early Childhood Education (ECE) to Elementary School (ES) marks a significant shift in a child's learning journey, involving changes in academic expectations, teaching approaches, and social environments. Tobin et al. (2022) emphasize that this transition is crucial not only for children but also for parents and teachers, as it requires active support rather than a passive waiting period for adaptation.

In practice, challenges often arise during this transition. Observations in the field indicate that some first-grade students struggle with basic literacy tasks, with some even experiencing distress when engaging in reading and writing activities. These difficulties stem from the fundamental differences between ECE and ES learning structures, where early childhood education emphasizes play-based exploration, while elementary education shifts towards structured academic learning.

To bridge this gap, implementing a well-structured ECE-ES transition program is essential. Such a program can serve as an adaptive framework to align learning characteristics between both education levels. Moreover, to maximize its effectiveness, the program should integrate engaging and meaningful learning experiences that actively develop students' foundational literacy skills. By fostering a supportive and stimulating environment, the transition process can become smoother, ensuring that students acquire the basic literacy competencies necessary for success in elementary education.

Basic literacy skills are critical components acquired by students as they learn the foundations from a very young age. Basic literacy skills are known to enable an individual to be more self-sufficient and to adapt and advance science and technology. Basic literacy skills play pivotal role , especially in everyday tasks and academic potential. In order to ensure maximised success, this literacy introduction process needs to be applied from early years. As we are aware, the brain rapidly grows in the early years of life and is highly adaptive to learning syllables, words, phrases, sentences, as well as phonological awareness. Pupils with solid foundational literacy skills will acquire literacy faster (Retno Winarni, 2023; Indriyani et al., 2019). With the introduction of early literacy, the awareness of literacy will increase in a nation and people will learn to source information in an effective, efficient, and logical way. Moreover, critically and appropriately assess knowledge, but also use it effectively and concisely (Ocak and Karslı 2022; Zhao and Lornklang 2019).

Furthermore, literacy in reading and writing is essential because of its substantial influence on other forms of literacy and student academic performance (Khofifah and Ramadan 2021; Muhdi et al. 2020). When students grasp reading and writing literacy, it can facilitate their performance in other academic endeavors, ultimately influencing their learning outcomes. Reading and writing literacies encompass all literacy competencies, facilitating comprehension of other literacy components essential for proficient reading skills. (Kemdikbud, 2021). Acquiring reading and writing literacy skills will enhance your capacity to comprehend other aspects of literacy, hence improving your reading proficiency.

The foundation of literacy is meaning, which is intimately tied to the ability to read and write. According to experts, literacy should be taught at a young age, particularly reading and writing literacy, through enjoyable and concrete activities (Fitria et al. 2022). A person's comprehension will be expanded by reading and writing; this second element is essential in life. Numerous research findings support the significance of early reading and writing skills, demonstrating their critical role in literacy success later in life, including achievement, where literacy skills influence academic success or failure (Dere 2019; Erkek 2022).

A good reading skill will impact someone's life and make them enjoy the reading moment for life. To acquire that skill, it is necessary to start teaching effective reading at a young age. Reading proficiency involves more than just memorizing letters; it also involves comprehending what has been read. The time between the ages of two and seven is crucial in determining how well youngsters develop their reading abilities. For kids to thrive in school and in life in general, they need to be literate.

Anwas et al. (2022) and Dewi (2019) found that early reading success is a powerful predictor of later literacy skills, which are closely linked to performance in a variety of fields.

Students who develop a love for reading early in their academic journey are more likely to become proficient readers, benefiting both their future academic success and personal enrichment. Research by Puspita and Cahyani (2018) highlights that students who cultivate a reading habit in school continue to improve their literacy skills over time, ultimately evolving into skilled and independent readers.

Equally important to literacy development is writing proficiency, which serves as the foundation for other literacy components. Writing engages all aspects of language, requiring students to actively integrate their reading, vocabulary, grammar, and critical thinking skills. Therefore, fostering strong writing abilities is essential, as writing enables students to articulate their thoughts, opinions, and emotions in a structured and meaningful way.

Writing is deeply interconnected with other language skills, including reading, speaking, and listening (Rahman et al., 2020). It is not only a linguistic ability but also a cognitive process that enhances intelligence, creativity, initiative, and perseverance (Ninawati, 2019; RuESianti, 2024). Furthermore, Nirwati emphasizes that writing strengthens critical thinking, originality, and information-gathering skills, making it a crucial component of a well-rounded education. By developing both reading and writing skills, students build a strong literacy foundation that supports their academic growth and lifelong learning.

Basic literacy skills in Indonesia are still below expectations, which is a worrisome situation. Based on Programme for International Student Assessment (PISA) data, Indonesian students had the same below-OECD average reading ability as their peers worldwide. While Indonesian students' had poor comprehension ability in understanding the drafts, their reading ability (comprehending factual relationships, distribution, and calling out linguistic logistics relationship), and suggesting reading (OECD 2021).According to the most recent PISA results for 2022, Indonesia improved five spots in the reading literacy category, although its score decreased 12 points from the year before to 359 (https://www.oecd.org/publication/pisa-2022-results/country-notes/indonesia-c2e1ae0e#chapter-d1e11.).

Generally, several organizational research found that Indonesian students still have low literacy level. Indonesian pupils ranked among the worst on the International Reading Literacy Study (PIRLS) from 2011 to 2014. Of the forty-eight countries participating in PIRLS, Indonesia was at forty. Moreover, Indonesia's Distribution Performance Reading (DPM) is below 500 (average/standard PIRLS scale) and ranks 41 out of 45 countries (Gustiana et al., 2023). Since the transition to e-PIRLS (electronic PIRLS) in 2016, Indonesian students have not participated, as the digitalization component would come with a greater burden as it is thought that they were performing at a lower end of the performance spectrum (Akan et al. 2023; Gustiana and Rahman 2021).

According to the 2016 Indonesian National Assessment Survey (INAP) the literacy levels among Indonesian pupils were 46.83% poor, 47.11% sufficient and 6.06% good (report issued by suspend. kemdikbud. go. id). Additionally, INAP 2016 literature became the basis of evaluation at the national level in Indonesia drawn from literary and non-literary texts. The results of the study showed that, in average this domain for literary content reached 27.65, while for the non-literary content category total score was higher at 43.34. This also is consistent with question no. 95. Moreover, a study conducted in 2016 by Central Connecticut State University in New Britain, Connecticut ranks Indonesia in second position out of 61 countries in literacy (OECD 2021).

The Early Grade Reading Assessment (EGRA) conducted across seven provinces (ACDPI, 2014) revealed significant literacy challenges among Indonesian students. Over 55% of 15-year-old participants in the PISA **test** were classified as functionally illiterate, meaning they could decode text but struggled with comprehension, highlighting inadequate reading proficiency (Pratiwi et al., 2020; Pratiwi & Puspito Hapsari, 2020).

Further studies indicate that fluency and comprehension difficulties significantly hinder early childhood literacy development in Indonesia (Chandra et al., 2021; Demirbaş & Şahin, 2022; Pratiwi &

Puspito Hapsari, 2020; Widyaningrum & Hasanudin, 2019). These issues compromise the effectiveness of literacy programs, often stemming from inadequate implementation and the inability to achieve intended learning outcomes.

Many children also face foundational literacy gaps, struggling to recognize letters and syllables despite their eagerness to associate words with visual representations. However, advancements in digital technology offer potential solutions. Innovative tools, such as speech-to-text applications and interactive displays, enable students—particularly those with learning difficulties—to participate in literacy activities without feeling excluded. Smartphones and other digital devices can facilitate engagement, providing accessible and adaptive learning experiences to bridge literacy gaps and improve reading comprehension.

Smartphones are becoming progressively portable and accessible to a wide audience. The utilization of a smartphone has dual facets, yielding both beneficial and detrimental effects contingent upon its application (Paridawati et al. 2021). Students' utilization of cellphones is anticipated to positively contribute to the requirements of 21st-century education, including teamwork, communication, critical thinking, creativity, character, and citizenship (Kalin 2022). The unified remote application on smartphones may transcribe spoken words into text. That application serves as an innovative learning tool inside the picture word inductive model (PWIM), which is a picture inductive model with smartphone assistance (PWIMSA). PWIMSA is a language acquisition model comprising phases that facilitate the enhancement of spoken language, vocabulary knowledge, phonological awareness, word analysis capabilities, reading comprehension, and the composition of words, phrases, sentences, and paragraphs. The stages of the PWIMSA are as follows:

Phase I: Students will observe pictures or photos and identify words related to objects in the picture.
Phase II: Students come to the front of the class to mention words and analyze pictures with the help of smartphones.
Phase III: Students explore using these words to form sentences with the help of smartphones.
Phase IV: Students explore creating titles that match the contents of the text using smartphones.
Phase V: Students will classify these sentences based on certain criteria.
Phase VI: Students explore developing texts from these sentences into more complete paragraphs or paragraphs with the help of smartphones (Gustiana 2024).

The application of PWIMSA, facilitated by smartphone, can accommodate all youngsters with varying literacy skills. Furthermore, the incorporation of smartphone in this paradigm aligns with the attributes of 21st-century learning, specifically Technological Pedagogical Content Knowledge (TPACK) (Haryanto and Arty 2019). The utilization of smartphones aims to enhance teachers' digital proficiency. Digital competence serves as an internal resource for educators to adapt to the transformations of the Fourth Industrial Revolution (Syahid et al. 2022; Kalin 2022). This study aims to assess the effect of the PWIMSA on enhancing literacy among students in the ECE-ES transition.

2. METHOD

This research employed a quasi-experimental approach with a pre-test - post-test control-group design without randomization (Gall et al. 2014). For additional information, the design is illustrated in Figure 5 below.

O	X	O
O	Y	O

Figure 1. Non-Randomized Pre-test-Post-test Control Group Design

O = observation, encompassing both pre-test and post-test
X = experimental condition
Y = control or comparative condition

2.1. Population and Research Sample

The research population comprised all first-grade primary school students in Bandung City during the 2023/2024 academic year. The selection of schools for the research samples employed a purposive sampling technique, specifically choosing those that have adopted the autonomous curriculum and piloted the ECE-ES transition program. Randomization was not implemented to select the experimental and control groups from the five schools. The experimental group comprised 93 kids from classes 1A and 1B of school I and class 1A of school II. The control group comprised 110 individuals from Class 1A of School III, Class 1A of School IV, and Class 1A of School V. The experimental group utilized a PWIMSA, whereas the control group engaged in a school literacy movement action, specifically reading aloud for 15 minutes and utilizing a reading and writing corner.

2.2 Instruments, Data Collection, and Data Analysis

The establishment of early reading and writing indicators functions as a fundamental literacy tool. Table 1 below presents additional facts.

Table 1. Indicators of Early Reading and Early Writing

No.	Variables	Indicator
1.	Pre- Reading	a. Phonological Awareness b. Decoding c. Linguistic Comprehension d. Oral Reading Fluency e. Reading Comprehension
2.	Pre- Writing	a. Clarity in Letter Composition b. Precision in Word and Sentence Construction c. Application of Capitalization and Punctuation

Source: (Grimma et al. 2018)

The collection of literacy ability data was conducted by observation rather than testing, emphasizing a more humanistic approach, particularly given that the research subjects were first-semester grade 1 students. The effect of selecting the observation technique is to facilitate the structuring of activities for evaluating students' competencies based on established indicators. Data on literacy proficiency was collected prior to the intervention (pre-test) and subsequent to the intervention (post-test). The action was granted for roughly six weeks.

The data analysis included descriptive statistics, normality assessments, homogeneity tests, paired t-tests, and independent t-tests. Descriptive statistics were conducted to present comprehensive maximum and minimum scores, as well as means and standard deviations of the pre-test and post-test data for both groups. Conduct a normality test to ascertain the distribution of data for both groups. A homogeneity test is used to ascertain whether the data is homogeneous or heterogeneous. The independent t-test was employed to assess the disparity in literacy proficiency between the experimental and control groups, and to ascertain whether group demonstrated greater efficacy if a difference was identified. The independent t-test was conducted using the gain data from both groups. All data analyses were conducted utilizing the SPSS 22.0 software.

3. FINDINGS AND DISCUSSION

3.1 Findings

This section provides the descriptive data for the analysis of the pre-test and post-test, as outlined in Table 2.

Table 2. The Results of Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
pretest experiment	93	30	38	68	54.60	8.038	64.612
pretest experiment	93	10	65	75	71.26	2.566	6.585
pretest control	110	30	38	68	52.52	7.545	56.931
posttest control	110	18	53	71	62.26	3.770	14.214
Valid N (listwise)	93						

Table 2 demonstrates that the application of the PWIMSA paradigm, positively impacted the pupils' basic literacy skills. The results of the descriptive data presented in Table 1 are indicative. The experimental class's average value rose from 54.60 to 71.26. Subsequent to the delivery of the drug, the students in the experimental class. Additionally, The descriptive statistics provide the minimum and maximum scores in the pre-test. Table 1 indicates that the pre-test recorded a minimum score of 38. Concurrently, the pre-test attained a highest score of 68. The post-test had a minimum score of 65 and a maximum score of 75. The alterations suggest that the implementation of the PWIMSA support influenced fundamental reading skills. Furthermore, the descriptive statistics were examined, and a normality test was performed to determine whether the obtained data originated from a population exhibiting a normal distribution. The outcomes of the normality test are presented in Table 3.

Table 3. The Results of Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
pretest experiment	.190	93	.160
posttest experiment	.181	93	.110
pretest control	.197	110	.131
pretest control	.196	110	.136

a. Lilliefors Significance Correction

The researcher performed the Kolmogorov-Smirnov normalcy test. Table 2 demonstrates that the significance level (Sig.) exceeded 0.05, suggesting that the collected data adhered to a normal distribution. Subsequent to the normality test, the researcher conducted the homogeneity test to ascertain whether the two data sets were from the same distribution. Table 4 presents the results of the homogeneity test.

Table 4. The Results of Homogeneity Test

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
0.715	26	171	.900

Table 4 indicates that the significance based on the mean exceeds 0.05, signifying that the gathered data has successfully passed the homogeneity test. The homogeneity test results demonstrated that the obtained data displayed a homogeneous distribution, since they originated from a similar distribution. Upon concluding the normality and homogeneity tests, the researcher advanced to the final analysis, termed the independent T-test. The purpose of this test was to assess two samples from different groups and ascertain whether the samples demonstrate differences. Furthermore, the independent T-test is intended to assess these assumptions:

Ha : The picture word inductive model with smartphone assistance (PWIMSA) paradigm, significantly influences students' basic literacy skills.

Ho : The picture word inductive model with smartphone assistance (PWIMSA) does not affect students' bbasic literacy skills.

The outcomes of the independent T-test are presented in Table 5.

Table 5. Results of the Independent T-Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
gain	Equal variances assumed	0.715	.900	7.911	201	.000
	Equal variances not assumed			7.709	165.121	.000

As shown in Table 5, the significance level (2-tailed) was found to be less than 0.05, which indicates a statistically significant association between the two variables. The PWIMSA has significantly different effect on student basic literacy skills if we compare with the guidance through the school literacy movement. Thus, it can be concluded that the alternative hypothesis was received as the picture word inductive model with smartphone assistance (PWIMSA) paradigm, which significantly influences students' basic literacy skills.

The improvement of fundamental literacy skills is apparent in all dimensions of literacy, encompassing phonological awareness, decoding, linguistic comprehension, oral reading fluency, reading comprehension, letter writing clarity, word or sentence writing accuracy, and the application of capital letters and punctuation. The calculation of the enhancement score in the pre-test and post-test is presented in Table 6.

Table 6. The Improvement of Critical Literacy Skills

Indicators	Experimental Class		Control Class	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Phonological Awareness	8.71	10.00	8.59	9.4
Decoding	4.12	5.00	4.04	4.49
Linguistic Understanding	7.31	9.91	7.06	8.32
Oral Reading Fluency	6.73	9.85	6.39	7.64
Reading Comprehension	8.06	9.87	7.75	8.32
Clarity of Writing Letters	7.75	9.49	7.43	7.92
Writing accuracy in words or sentences	6.36	9.06	6.03	6.77
Use of capital letters and punctuation	5.55	8.06	5.23	5.77
Average Score	6.82	8.91	6.56	7.33

Table 6 indicates that the basic literacy ability which obtained the highest improvement score (3.12) was oral reading fluency. Reading fluency is the most essential aspect of literacy (Grimma et al. 2018). Figure 2 and 3 show pretest-posttest data on basic literacy abilities between the experimental and control groups.

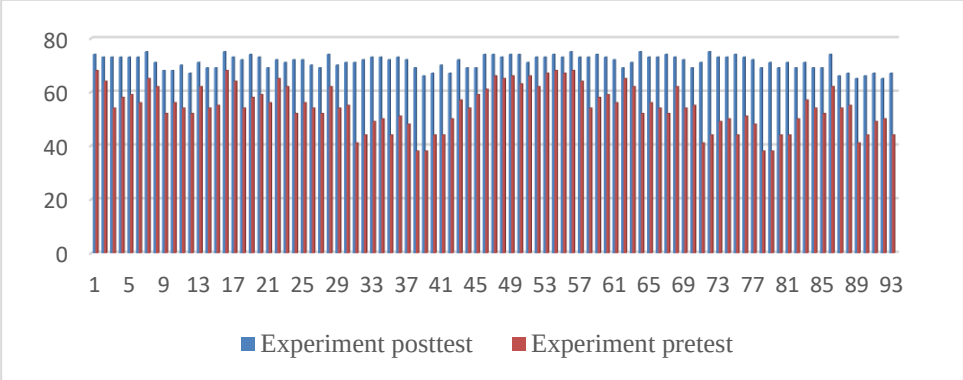

Figure 2. Pre-Test and Post-Test of Students' Basic Literacy in the Experiment Class

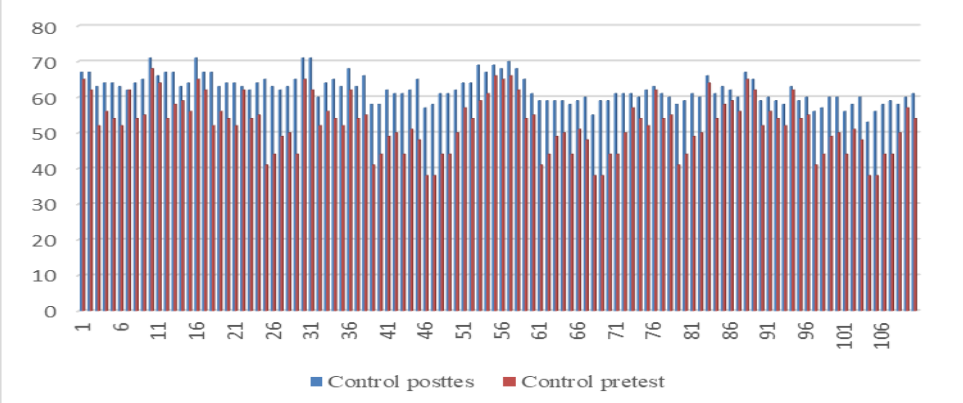

Figure 3. Pre-Test and Post-Test of Students' Basic Literacy in the Control Class

3.2 Discussion

The learning quality of first-grade primary learners (Ginsburg and Opper 2016) indicates measurable pre-operational advancement. Students need physical objects or visual representations to

help them understand at this phase. Literacy involves the ability of students to understand what is written and read (Akan et al. 2023; Zen et al. 2023). As an example, the cognitive dimension entails comprehension, which is a fundamental aspect of literacy that consists of language and cognitive attributes. The speech of children is closely related to their cognitive abilities.

The picture word inductive model with smartphone assistance (PWIMSA) approach facilitates learning by enabling pupils to generate words derived from the presented visuals. Throughout this process, students construct words mentally based on their visual observations of the image (Joyce et al. 2016). Students' cognitive abilities will be enhanced when they formulate words using visual aids. Furthermore, pupils will comprehend both their writing and reading. Students lacking reading and writing skills can nevertheless engage in this exploratory activity with the use of smartphones, specifically utilizing the unified remote application and Google Voice. Students can enhance their critical thinking abilities by constructing words, sentences, and paragraphs utilizing these patterns. Concise phrases and paragraphs will be constructed utilizing the vocabulary acquired through visual stimuli. Students can utilize these models to articulate the words or paragraphs they have composed, facilitating a seamless transition from their expressions to their writing. Students subsequently replicate the writing in their notebooks. This strategy is more effective in enhancing pupils' talents.

Vygotsky's three principal notions are tools of the mind, the zone of proximal development (ZPD), and scaffolding, which elucidate the learning process. The tools of the mind denote that cognitive task necessitate the utilization of instruments to aid pupils in comprehending concepts, resolving issues, retaining knowledge, and enhancing clarity of thought. For instance, items like rocks, beads, and sticks are utilized to assist toddlers in comprehending the concept of numbers. ZPD denotes the zone in which development is anticipated to transpire imminently. The term "zone" exemplifies that growth pertains to a region rather than a singular spot. The scaffolding element, characterized by adult aid, facilitates the transition of students from the zone of proximal development (ZPD) to the zone of potential development (ZPoD) (Akan et al. 2023; Ocak and Karslı 2022; Pindiprolu and Forbush 2021).

Based on Vygotsky's learning theory, the Picture Word Inductive Model with Smartphone Assistance (PWIMSA) functions as a cognitive tool within the ECE-ES transition program, while teachers provide scaffolding to help students reach their Zone of Proximal Development (ZPoD). This approach is particularly effective in enhancing foundational literacy skills, as it aligns with essential components of early reading and writing development (Joyce & Weil, 2003).

PWIMSA strengthens key literacy skills such as phonological awareness, decoding, linguistic comprehension, oral reading fluency, reading comprehension, letter writing clarity, word and sentence accuracy, and proper use of capitalization and punctuation. These elements are critical for early learners as they transition from ECE to elementary school.

A significant advantage of PWIMSA is its flexibility in different technological environments. The model operates using internet access, synchronizing between laptops and smartphones with the same login credentials. However, in schools without internet access, PWIMSA can still function using Bluetooth connectivity. While the program requires either a laptop or smartphone, it remains user-friendly, utilizing a simple speaker icon for audio-based learning.

Additionally, PWIMSA contributes to digital literacy development among teachers, allowing them to integrate technology into their teaching strategies effectively. By incorporating PWIMSA, educators not only improve students' literacy skills but also enhance their own technological proficiency, making it a valuable tool for modern classrooms.

4. CONCLUSION

The Picture Word Inductive Model with Smartphone Assistance (PWIMSA) and the school literacy program both contribute significantly to improving students' fundamental literacy skills. However, findings indicate that PWIMSA is more effective in enhancing literacy competencies, as reflected in its

higher average gain score. PWIMSA supports students with limited literacy skills by utilizing a remote application that converts audio into text, making it adaptable to diverse learning readiness and interests. This approach allows teachers to better facilitate fundamental reading development compared to the traditional school literacy movement, which may not fully address the needs of illiterate students. Additionally, PWIMSA effectively bridges the learning gap between Early Childhood Education (ECE) and Elementary School (ES), reinforcing its relevance to the transition program.

Despite these promising findings, the study has limitations, particularly in terms of sample representativeness, as it was conducted within a limited geographical and institutional scope. Future research should expand the sample size and diversity to ensure broader applicability and reliability of the results. Additionally, further studies could explore long-term impacts of PWIMSA on literacy development and its potential integration with other digital learning tools to enhance early literacy instruction.

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