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| RESEARCH ARTICLE

Digital Scaffolding for Literacy: The Effectiveness of a Google Sites-Assisted CIRC Model in Enhancing Secondary Students' Text-Based Composition Skills

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| ABSTRACT
The incorporation of digital technology in literacy education has gained significance, particularly in environments with few conventional resources. Students in rural Indonesian schools frequently encounter difficulties with reading-writing integration, while educators grapple with the implementation of effective, collaborative instructional strategies. Although cooperative learning strategies, such as the Cooperative Integrated Reading and Composition (CIRC) model, have demonstrated potential, there is a deficiency in research regarding the enhancement of these models through digital scaffolding in low-resource environments. This study presents a Google Sites-supported CIRC model designed to enhance secondary students' text-based composing abilities. The model was validated, assessed for practicality, and evaluated for efficacy using a research and development (R&D) methodology with a one-group pretest-posttest design. Results demonstrate elevated expert validation scores (CVI = 0.92), robust practicality assessments from both educators and students, and substantial enhancements in writing ($p < 0.001$; Cohen's $d = 1.12$), especially among low-proficiency learners. Qualitative data additionally indicate heightened motivation, collaboration, and digital proficiency. The research shows that integrating cooperative learning with accessible digital platforms can significantly enhance literacy results in under-resourced settings. It provides a reproducible and scalable framework for addressing literacy disparities via technology-enhanced education, with ramifications for curriculum design, educator training, and digital equity.

| KEYWORDS
Digital Scaffolding, Cooperative Learning, Literacy Instruction, Google Sites, Rural Education

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1. Introduction

In the 21st century, literacy transcends the conventional skills of reading and writing; it is increasingly characterized by a student's capacity to acquire, absorb, synthesize, and transmit information across various modalities and digital platforms (Jones & Hafner, 2021; Zhang & Yu, 2023a). Literacy has transformed into a multifaceted construct, incorporating digital, media, visual, and critical literacy as vital skills for managing a swiftly changing knowledge society (OECD, 2021). Text-based composition—the ability to organize, articulate, and present ideas through coherent written discourse—remains a crucial pillar of academic success and lifelong learning (Graham & Harris, 2021). Global education systems underscore the pivotal importance of writing in cultivating critical thinking, reflective learning, and disciplinary comprehension (Graham & Harris, 2021). In the digital era, writing transcends traditional pen-and-paper methods; it encompasses composition through digital tools and online platforms, where collaboration, multimodal integration, and iterative feedback are essential activities (Zhang & Yu, 2024a; Ho, 2024). Notwithstanding this transition, numerous students—particularly in poor nations or rural areas—strive to attain fundamental skill in written communication. The difficulty is more pronounced at the secondary level, where students must exhibit advanced composing abilities in readiness for higher education and the workforce. The notion of scaffolding, first based on Vygotsky's sociocultural theory, is widely acknowledged as an essential instructional method for facilitating literacy acquisition. Scaffolding entails offering systematic help to learners at the limits of their abilities, progressively diminishing aid as autonomy increases

(Kim, 2022). The rise of educational technology has led to the increased adoption of digital scaffolding as an effective pedagogical method to promote self-regulated learning, improve engagement, and develop advanced cognitive skills, such as academic writing (Kim, 2022). The Cooperative Integrated Reading and Composition (CIRC) model is a distinguished teaching approach that effectively combines reading and writing skills through cooperative learning. Recent empirical research in Indonesia indicates that CIRC markedly enhances reading comprehension and writing proficiency among secondary students (Paskalia Wae & Herwin, 2024; Frimaulia & Suprayetno, 2021), while implementation studies reveal its beneficial effects in EFL environments (Rafi'ah Nur, 2021).

Nonetheless, despite its shown educational efficacy, the application of CIRC in traditional classrooms has frequently been hindered by logistical obstacles, time constraints, and insufficient technological integration (Atabek, 2025; Lin & Chen, 2024). This issue is particularly concerning as contemporary learners, often termed digital natives, thrive in technologically enriched environments that provide flexibility, engagement, and access to a variety of materials (Zou et al., 2025). A promising instrument that supports collaborative learning and digital scaffolding is Google Sites, which allows educators and learners to create, share, and interact with multimedia-rich content. Google Sites facilitates CIRC by providing an asynchronous, interactive environment for collaborative reading, authoring, amending, and publication of written material (Daud et al., 2024; Mustafa et al., 2022). Previous studies demonstrate that Google Sites improves learners' digital literacy, motivation, and cognitive engagement, particularly in inquiry- and project-based learning contexts (Sholahuddin & Rini, 2025; Sagita et al., 2023). However, the relationship between Google Sites as a digital scaffolding tool and the CIRC instructional framework for enhancing text-based composition among secondary students is little explored in empirical research, especially in under-resourced or rural educational settings.

Notwithstanding the growing focus on digital literacy and collaborative technologies in educational settings, there exists a deficiency of research-driven models that amalgamate digital scaffolding with organized cooperative learning frameworks like CIRC (Becker & Park, 2022; Goldin & Molnar, 2021). Current research frequently regards technology as an ancillary instrument or assesses individual applications without integrating them into comprehensive instructional frameworks (Özdener & Güldemir, 2023; Li & Ni, 2024). Moreover, the majority of studies on digital tools for writing instruction focus on higher education or urban settings, resulting in a significant void concerning their relevance and efficacy in rural secondary schools (Suprayogi et al., 2023; Prawiro & Sari, 2025).

A conceptual gap persists in comprehending how platforms such as Google Sites can be systematically integrated into writing instruction—not merely as repositories, but as interactive, student-centered scaffolds that facilitate learners' engagement in reading, collaboration, composition, feedback, and reflection (Chen & Yang, 2024; Munshi et al., 2022). The cumulative effect of this integration on quantifiable writing outcomes—specifically enhancements in structure, coherence, grammar, and expression—has yet to be thoroughly investigated (Han & Shin, 2023; Park & Lee, 2024).

In nations such as Indonesia, where extensive evaluations like PISA continuously indicate inadequate reading and writing competency, the necessity for contextually relevant, technology-augmented teaching methods is becoming increasingly critical. Many government literacy initiatives continue to be devoid of enduring pedagogical frameworks that effectively integrate cooperative learning and digital assistance (Suprayogi et al., 2023; Prawiro & Sari, 2025).

This study develops and assesses a Google Sites-assisted CIRC learning paradigm to improve secondary students' text-based composing skills. A prototype model was developed using an R&D methodology grounded in the ADDIE framework, incorporating six essential stages: Introduction, Grouping, Shared Reading, Collaborative Literacy, Publication & Evaluation, and Consolidation & Reflection, all integrated within a Google Sites platform designed for literacy instruction.

This work presents the design, validation, and experimental testing of the model in many secondary schools in Majene Regency, Indonesia. The examination comprised expert validation, practicality evaluations, and effectiveness testing utilizing a pretest-posttest design, accompanied by statistical analysis via paired t-tests. Students with diverse literacy competence levels participated, enabling the analysis of the model's varied impact across learner profiles.

The findings indicate that the Google Sites-supported CIRC model offers a realistic, valid, and statistically significant framework for enhancing students' writing performance in organized, collaborative, and technology-enhanced settings. This research enhances the expanding domain of digital literacy and collaborative pedagogy by presenting a reproducible educational framework substantiated by empirical data. It offers strategic insights for curriculum designers, teacher educators, and policymakers aiming to incorporate technology and pedagogy to promote inclusive and effective reading instruction in many educational environments.

2. METHOD

2.1 Research Design

This study utilized a Research and Development (R&D) methodology to design, create, and validate an educational model intended to improve students' text-based composing abilities. The ADDIE model was employed to direct the development process, comprising five systematic phases: Analysis, Design, Development, Implementation, and Evaluation. This paradigm was chosen for its adaptability and efficacy in instructional design, especially in technology-enhanced learning contexts.

The study employed a quantitative quasi-experimental design to assess the model's efficacy in actual classroom environments. The One-Group Pretest-Posttest Design was utilized, involving the evaluation of a single group of students prior to and following the intervention through comparable writing assignments. This design allowed researchers to quantify the extent of enhancement in students' composition performance resulting from the Google Sites-assisted CIRC learning model. A statistical study was performed to assess the significance of the reported learning gains and to validate the model's effect.

2.2 Research Setting and Participants

The research was carried out at many junior high schools in Majene Regency, Indonesia, an area noted for its varied educational backgrounds and restricted access to digital learning tools. The research setting was deliberately chosen to evaluate the relevance and efficacy of the digital scaffolding paradigm in a rural educational environment.
The participants included Grade VII and VIII students actively involved in Indonesian language sessions concentrating on reading and writing. Furthermore, Indonesian language educators who consistently conducted literacy instruction participated in the support of the implementation and observation phases.
A stratified random sample technique was utilized to guarantee representation across diverse reading levels. Students were classified into three literacy proficiency tiers—high, medium, and low—according to diagnostic test outcomes and educator evaluations. This stratification allowed the researchers to assess the model's efficacy across various learner profiles and assure a more refined comprehension of its educational influence.

Table 1. Student Literacy Proficiency Distribution

School	High Proficiency	Medium Proficiency	Low Proficiency	Total Students
SMPN 1 Majene	12	15	8	35
SMPN 2 Majene	10	18	7	35
SMPN 3 Majene	9	14	9	32
SMPN 4 Majene	8	16	10	34
SMPN 5 Majene	11	17	6	34

Table 1 illustrates the distribution of junior high school pupils across five schools in Majene Regency, classified by their reading proficiency levels. Each row displays the quantity of pupils categorized by high, medium, and low reading levels, in addition to the total number of participants from each school. The majority of students are categorized as having medium competency, signifying a considerable foundation for enhancement through focused instruction. SMPN 2 Majene and SMPN 5 Majene exhibit very equitable distributions, whereas SMPN 4 Majene has a greater percentage of low-proficiency students. These data facilitate the evaluation of the created model across distinct learner profiles, enhancing the generalizability of the findings to various educational environments in rural Indonesia.

Figure 1. Distribution of Literacy Proficiency Levels Among Participating Schools

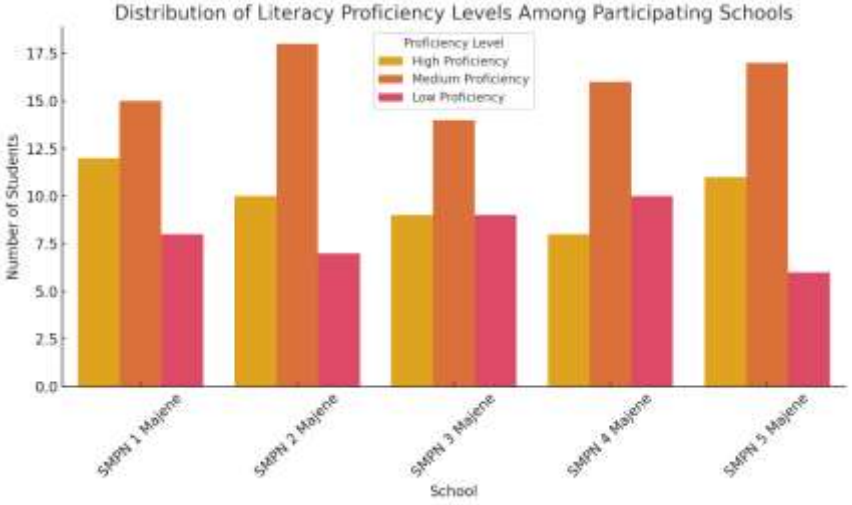

Figure 1 depicts the stratified distribution of pupils' literacy proficiency levels—high, medium, and low—across five junior high schools in Majene. Every school exhibits a discernible concentration in the medium proficiency category, consistent with the national literacy trend observed among middle-grade students. Students with high proficiency are fewer in number, however low-proficiency learners continue to pose a considerable challenge in several schools, especially SMPN 4 Majene. This graphic representation substantiates the justification for employing a varied educational paradigm, such as the Google Sites-assisted CIRC, to meet diverse reading requirements. The variation in proficiency levels among schools bolsters the credibility of the intervention's efficacy across diverse learner groups.

2.3 Product Development Procedure

The instructional model was developed using the ADDIE paradigm, comprising five iterative phases: Analysis, Design, Development, Implementation, and Evaluation. During the Analysis phase, a requirements assessment was performed via interviews and questionnaires with educators and students to ascertain existing issues in literacy instruction and digital integration. In the Design phase, lesson plans and digital learning modules were developed based on the Cooperative Integrated Reading and Composition (CIRC) model, tailored for execution using Google Sites. During the Development phase, the instructional prototype was established, encompassing online resources, organized group activities, and composition assignments housed on the Google Sites platform. The Implementation phase encompassed pilot testing in two stages: an initial trial with a single class and a subsequent trial across many schools. Ultimately, during the Evaluation phase, expert validation, practicality assessment, and statistical testing were performed to ascertain the model's validity, usability, and efficacy.

2.4 Instruments and Data Collection

A variety of tools were utilized to provide extensive data collecting during the research procedure. A needs analysis questionnaire was administered to students and teachers to collect insights into present literacy practices, learning challenges, and digital engagement. Expert validation sheets were employed to evaluate the model's content, construct alignment, and digital media design. Observation sheets documented the feasibility and fidelity of model implementation during classroom execution. To evaluate practicality, student response surveys were distributed subsequent to the intervention. Furthermore, pretest and posttest writing assignments were employed to assess students' text-based composition abilities and ascertain the model's efficacy.

Data were gathered using multiple methodologies. Surveys and structured interviews were administered to get qualitative and quantitative feedback from participants. Classroom observations yielded immediate data on student engagement and model implementation. Document analysis facilitated the evaluation of teaching materials, whereas writing performance evaluations provided quantifiable measures of literacy enhancement over time.

2.5 Validity and Reliability

A thorough process of validity and reliability testing was undertaken to confirm the rigor of the established model and its accompanying instruments. Expert validation included specialists in education, digital media, and literacy teaching who evaluated the model's theoretical alignment, instructional coherence, and technology integration. Insights from these specialists informed essential modifications to enhance the model's design and functionality.

The Content Validity Index (CVI) was employed to assess each element of the model, encompassing lesson plans, instructional phases, and digital resources. The CVI scores demonstrated robust consensus among validators regarding the pertinence and lucidity of the items.

Cronbach's Alpha was computed to evaluate the internal consistency of several items in questionnaires and observation sheets, hence assessing instrument reliability. Furthermore, Pearson product-moment correlation was utilized to assess the construct validity of the measuring items. The results exhibited satisfactory reliability and robust correlations, validating the trustworthiness of the research tools employed in this study.

2.6 Data Analysis Techniques

This study utilized both qualitative and quantitative analytical methods to achieve a comprehensive knowledge of the data. Qualitative analysis involved the examination of data derived from interviews, open-ended questionnaires, and classroom observations using thematic coding, facilitating the recognition of recurring patterns, themes, and insights pertaining to students' literacy issues and their responses to the model.

Descriptive statistics, including mean, standard deviation, and percentages, were utilized for quantitative analysis to describe the requirements assessment data and student feedback regarding the model's feasibility. To assess the efficacy of the Google Sites-assisted CIRC model, paired sample t-tests were performed to compare pretest and posttest writing scores, analyzing notable enhancements in students' composition performance.

Furthermore, normality tests (Kolmogorov–Smirnov) were employed to assess data distribution prior to inferential analysis. Cohen's d was calculated when applicable to assess effect sizes, offering a more lucid explanation of the practical significance of the observed learning improvements.

2.7 Ethical Considerations

This study complied with rigorous ethical standards to safeguard the rights and welfare of all participants. Informed consent was secured from children, their parents or guardians, and the relevant school administrations prior to data collection. Participants were explicitly apprised of the study's objectives, methodologies, potential hazards, and their entitlement to withdraw at any moment without repercussions.

To maintain secrecy, all personal data were anonymized with coded identifiers, and results were presented in aggregate form to avert the revelation of specific identities. All digital data, encompassing interview transcripts and student evaluations, were securely stored with limited access.

The work was reviewed and approved by the Institutional Review Board (IRB) or a comparable ethics body, where relevant, to ensure adherence to ethical standards for research involving minors. This process ensured that the research upheld transparency, respect, and equity in all interactions with participants and educational stakeholders.

3. RESULTS

3.1 Needs Analysis Findings

The needs analysis phase uncovered numerous essential findings concerning the difficulties encountered by both students and educators in literacy instruction. Data collected from interviews and surveys revealed that students had considerable challenges in synthesizing reading and writing skills, especially in producing coherent compositions derived from source sources. A multitude of pupils encountered difficulties in interpreting core concepts, synthesizing knowledge, and articulating their opinions proficiently in writing. These difficulties were most pronounced among children with diminished literacy proficiency, who frequently depended on rote copying instead of generating creative compositions.

Educators expressed significant difficulties in providing integrated literacy education, noting an absence of organized frameworks and restricted access to digital resources. The majority of educators had a profound aspiration to enhance student involvement however lacked clarity on how to utilize technology successfully within the classroom. Furthermore, both students and educators exhibited a distinct preference for collaborative and digital learning settings. Students said that collaborative work and the utilization of digital technologies enhanced the enjoyment of learning and diminished its intimidation factor. Educators acknowledged that pupils exhibited heightened responsiveness and engagement when technology was integrated. The findings validated the pressing necessity for a systematic, technology-enhanced instructional framework to facilitate literacy advancement via collaborative and student-centered learning methodologies.

Table 2. Needs Analysis Summary

Category	Students Reporting (%)	Teachers Reporting (%)
Reading-Writing Integration Difficulty	68	55
Limited Digital Resources	42	85
Lack of Instructional Models		90
Student Preference for Collaboration	73	65
Student Preference for Digital Tools	78	70

Table 2 encapsulates the principal findings from the needs analysis conducted with both students and educators. A substantial percentage of students (68%) indicated challenges in synthesizing reading and writing, especially in structuring ideas and composing coherent written works. Educators corroborated this concern, with 55% recognizing analogous concerns in their teaching practices. Significantly, 90% of educators recognized the absence of formal instructional models as a primary barrier, while 85% reported restricted access to digital materials. Moreover, students demonstrated a pronounced inclination towards collaborative learning (73%) and the utilization of digital resources (78%) to facilitate literacy tasks. These observations emphasize the pressing necessity for a cohesive, technology-enhanced methodology for literacy education. The convergence of concerns among both groups substantiates the significance of the suggested Google Sites-assisted CIRC model.

Figure 2. Needs Analysis Findings: Literacy and Technology Challenges

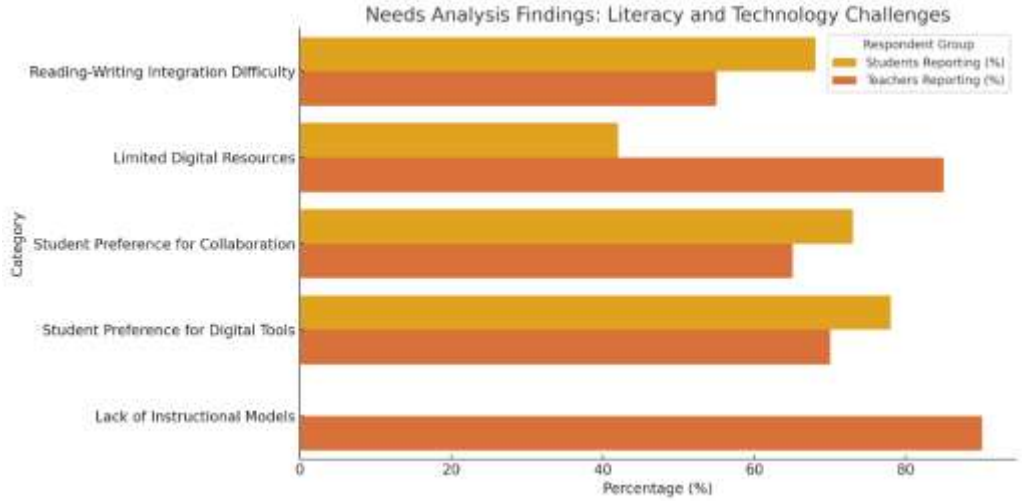

Figure 2 clearly contrasts student and instructor responses across five designated categories of need. Ninety percent of teachers indicated the absence of appropriate instructional models for reading-writing integration, while eighty-five percent emphasized a deficiency in digital infrastructure. Conversely, students exhibited a pronounced preference for digital tools (78%) and collaborative learning (73%), indicating a significant readiness to embrace technology-enhanced teaching. Both groups recognized reading-writing integration as a challenge, although the numbers differed—students (68%) were more impacted than teachers (55%). The chart highlights the correlation between instructional constraints and learner preferences, making a strong argument for the use of a digital scaffolding paradigm such as Google Sites-assisted CIRC. This method has the capacity to close the educational gap while improving student motivation and engagement.

3.2 Prototype Model Description

The constructed prototype model is a Google Sites-facilitated Cooperative Integrated Reading and Composition (CIRC) educational design intended to improve students' literacy, specifically in text-based composition. The methodology incorporates the fundamental elements of CIRC—cooperation, reading, writing, and peer feedback—within a digital learning framework facilitated by Google Sites. This integration facilitates both synchronous and asynchronous literacy activities, catering to diverse learning preferences and enhancing student autonomy.

The educational process is organized into six sequential phases: (1) Introduction, wherein students investigate learning objectives and digital resources; (2) Grouping, during which students are allocated to diverse teams; (3) Shared Reading, encompassing group reading and comprehension activities utilizing online texts; (4) Collaborative Writing, in which students jointly create written works through structured prompts; (5) Publication & Evaluation, permitting students to disseminate their work on Google Sites and participate in peer feedback; and (6) Reflection, where learners assess their progress and establish future writing objectives.

The Google Sites platform encompasses interactive lesson pages, embedded movies, digital worksheets, writing templates, peer feedback forms, and reflection logs. These elements are intended to enhance students' cognitive processes and facilitate collaborative, self-directed, and engaging reading training in a completely digital manner.

Table 3. CIRC Model Stages and Digital Features

Stage	Main Activity	Google Sites Features
1. Introduction	Explore learning objectives and digital resources	Welcome page, instructional videos, digital rubrics
2. Grouping	Assign students to heterogeneous groups	Group directory, student access controls
3. Shared Reading	Read online texts and answer comprehension questions	Embedded reading texts, quizzes, annotation tools
4. Collaborative Writing	Co-author compositions using guided prompts	Writing templates, comment features, Google Docs integration
5. Publication & Evaluation	Publish final drafts and conduct peer evaluations	Webpage publishing, peer feedback forms
6. Reflection	Reflect on learning and set writing goals	Reflection logs, self-assessment

	checklists

Table 3 delineates the six organized phases of the Google Sites-assisted CIRC model and emphasizes the corresponding learning activities and digital functionalities. Each phase is purposefully coordinated with educational and technological elements. The Introduction step involves learners through instructional videos and digital rubrics, whilst the Collaborative Writing phase incorporates writing templates and Google Docs for simultaneous co-authoring. During the Publication & Evaluation phase, students utilize peer feedback forms to assess their group's published drafts. This framework embodies a methodical and interactive strategy for literacy training, utilizing digital technologies to support each phase of the learning process. The correlation between learning phases and Google Sites features illustrates how digital platforms can facilitate organized, student-focused literacy advancement via accessible, collaborative, and reflective tasks.

Figure 3. Sequential Learning Stages in the Google Sites-Assisted CIRC Model

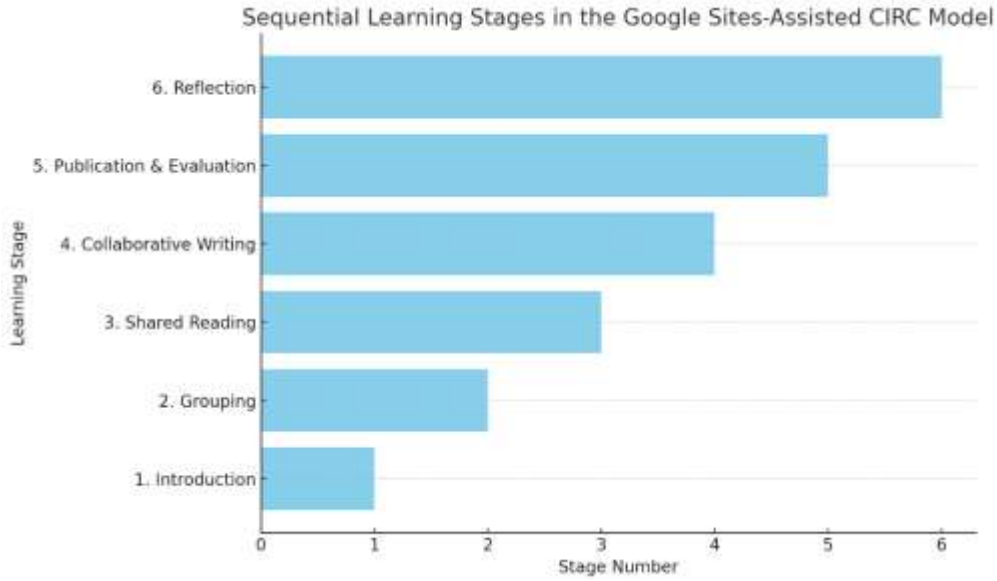

Figure 3 illustrates the six consecutive steps of the Google Sites-assisted CIRC model. The design highlights a gradual learning trajectory, commencing with foundational information and advancing to peer assessment and self-reflection. This visualization illustrates the organized framework of the instructional paradigm, guaranteeing that students progressively develop their reading and writing skills through scaffolded group activities. Each phase is enhanced with particular digital functionalities integrated into Google Sites, facilitating interaction, understanding, collaborative knowledge building, and metacognition. The depiction highlights the cyclical and reflective nature of the paradigm, with the concluding step encouraging learners to evaluate their progress and establish future objectives. The chart enhances the table by illustrating the intricate relationship between pedagogical design and digital resources in facilitating effective literacy training.

3.3 Expert Validation Results

An expert validation process was conducted to ensure the quality and theoretical rigor of the established instructional model, comprising specialists in literacy education, instructional design, and educational technology. The validation emphasized three principal aspects: content correctness, construct alignment, and media design excellence. Each expert employed a systematic validation sheet to evaluate the relevance, clarity, coherence, and appropriateness of the model components. The assessment produced elevated validation ratings in all dimensions, with the Content Validity Index (CVI) averaging 0.92, signifying a substantial consensus among experts over the model's validity.

The validators confirmed that the model's instructional objectives were consistent with literacy learning requirements and the Indonesian junior secondary curriculum. The stages of the CIRC model were considered logically ordered and pedagogically valid for construct validity. The media design elements, especially those created on Google Sites, received commendation for their intuitiveness, aesthetic appeal, and accessibility for both students and educators. Nonetheless, other recommendations were offered, such as streamlining educational rubrics, incorporating visual aids during the reflection phase, and improving user navigation on the site. All suggestions were integrated into the updated model to enhance its clarity and functionality.

Table 4. Expert Validation Scores

Validation Aspect	CVI Score	Interpretation
Content Validity	0.93	Very High
Construct Validity	0.91	Very High
Media Design Validity	0.92	Very High

Table 4 displays the Content Validity Index (CVI) results for the three fundamental components of the created instructional model: content, construct, and media design. All dimensions attained CVI scores over 0.90, classified as "Very High" per established validation criteria. Content Validity received the highest score (0.93), demonstrating robust agreement between the instructional materials and curricular objectives. The Construct Validity was measured at 0.91, affirming that the model steps were logically ordered and pedagogically sound. The Media Design Validity, with a score of 0.92, indicates the experts' favorable assessment of the visual, functional, and technological quality of the Google Sites platform utilized in the model. These findings confirm the model's resilience and educational efficacy.

Figure 4. Expert Validation Results of the CIRC Model

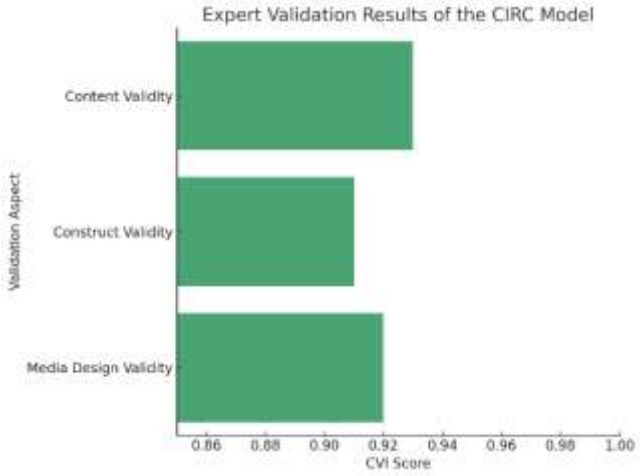

Figure 4 illustrates the CVI scores across three validation domains: content, construct, and media design. The picture demonstrates that all scores reside within the 0.90–0.93 range, signifying a uniform degree of expert consensus and substantial confidence in the model's validity. This underscores that the CIRC learning paradigm, facilitated by Google Sites, is both pedagogically valid and technically suitable for improving literacy training. The chart's visual clarity underscores that all three model components adhere to stringent academic requirements, therefore validating its application in wider instructional settings. The graphical representation further illustrates the model's preparedness for classroom implementation following expert-driven enhancement.

3.4 Practicality Testing

Practicality testing was performed to assess the usability, clarity, and functioning of the Google Sites-supported CIRC model during both short-term and long-term classroom sessions. Implementation observations indicated that the model was executed seamlessly in both environments, with little technical difficulties and substantial student engagement throughout the activities. Educators indicated that the instructional progression was straightforward and that the digital platform facilitated class delivery and oversight.

Responses from students and teachers were collected via standardized questionnaires. The instructor response data revealed that 94% found the concept easy to execute, whereas 91% concurred that it effectively facilitated collaborative writing. Simultaneously, students reacted well, with 88% indicating that the Google Sites interface was intuitive, and 85% noting heightened motivation to engage in writing assignments.

Descriptive data from the practicality instruments indicated a mean score of 4.52 on a 5-point Likert scale across parameters including accessibility, engagement, clarity of instructions, and group collaboration. These data indicate that the concept is exceptionally feasible and captivating for classroom implementation. The ongoing input from both groups validates the model's appropriateness for various student demographics and pedagogical approaches, especially in rural and resource-constrained educational environments.

Table 5. Practicality Testing Results

Indicator	Mean Score (out of 5)	Positive Response Rate (%)
Ease of Implementation (Teachers)	4.7	94
Support for Collaborative Writing (Teachers)	4.6	91
User-Friendliness of Platform (Students)	4.5	88
Motivation to Participate (Students)	4.4	85

Table 6 displays the outcomes of practicality testing derived from feedback provided by both educators and students. The average scores, assessed on a 5-point Likert scale, span from 4.4 to 4.7, signifying a substantial consensus on the model's usability and usefulness. Educators indicated the highest rating (4.7) for ease of implementation, affirming that the Google Sites-supported CIRC model was intuitive and effectively organized for classroom execution. Likewise, collaborative writing assistance received a rating of 4.6. The platform's user-friendliness garnered an average score of 4.5 from students, while desire to participate in writing projects was evaluated at 4.4. The scores, coupled with positive response rates of 85%, indicate that the model is exceptionally practical and pleasant for implementation in actual classroom environments.

Figure 5. Practicality Testing Results: Teacher and Student Responses

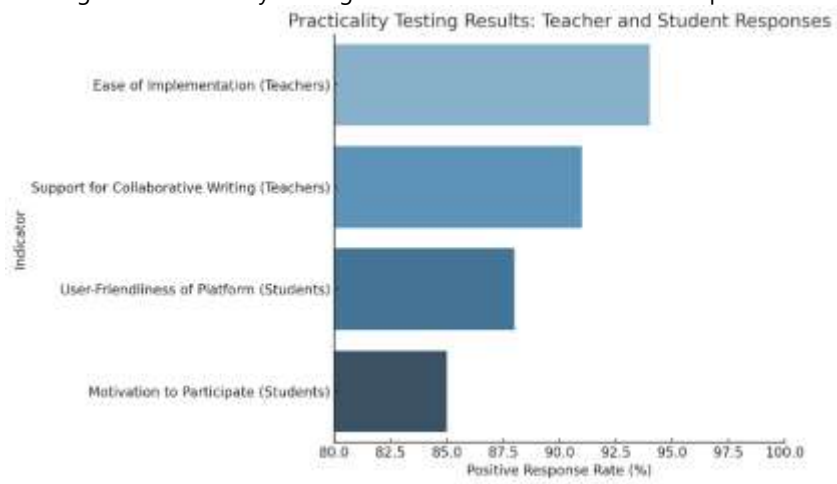

Figure 5 depicts the affirmative response rates from both educator and student participants for the model's applicability. Teachers had the highest approval rating at 94% for simplicity of implementation, followed by a robust 91% for collaborative writing help. Students exhibited favorable responses, with 88% deeming the platform user-friendly and 85% indicating heightened motivation. This graphic underscores the model's robust endorsement among stakeholder groups and affirms its efficacy in promoting digital, collaborative, and engaging literacy training. The limited variation of high scores among indicators indicates uniform performance across learning aspects and validates the model's suitability for various school settings, including those with limited resources.

3.5 Effectiveness Testing

The efficacy of the Google Sites-assisted CIRC model was assessed through a one-group pretest-posttest approach to quantify students' advancement in text-based creation. Writing assessments were conducted prior to and during the intervention, revealing a uniform enhancement in posttest scores across all skill tiers. Students with initially low proficiency had the greatest improvements, succeeded by those in the medium and high proficiency categories, demonstrating that the model effectively catered to varied reading requirements.

A paired sample t-test indicated a substantial difference between pretest and posttest scores, with $p < 0.001$, demonstrating that the model significantly influenced students' writing performance. The average score change was 10.78 points, indicating advancements in coherence, vocabulary, organization, and critical thinking in writing.

The effect size, quantified using Cohen's d, was determined to be 1.12, signifying a large impact size. This indicates not only statistical relevance but also considerable practical advantages for classroom learning. The findings confirm that the amalgamation of collaborative learning and digital scaffolding substantially enhances students' writing skills, rendering the model both effective and adaptable for wider educational application, particularly in environments with restricted access to sophisticated learning resources.

Table 6. Effectiveness Test Results

Proficiency Level	Mean Pretest Score	Mean Posttest Score	Score Gain
High	76.5	83.1	6.6
Medium	68.2	78.5	10.3
Low	60.4	74.9	14.5

Table 6 encapsulates the efficacy of the Google Sites-assisted CIRC model across three literacy proficiency tiers: high, medium, and poor. All groups exhibited significant enhancements from pretest to posttest scores, with the low proficiency group attaining the greatest score increase (14.5 points), succeeded by the medium group (10.3 points) and the high group (6.6 points). This indicates that the paradigm is especially beneficial for underperforming students, offering essential scaffolding to facilitate writing advancement. The persistent rising trend among groups confirms the model's adaptability and its capacity to address learning disparities across various learner profiles, particularly in under-resourced educational environments.

Figure 6. **Comparison of Pretest and Posttest Scores by Proficiency Level**

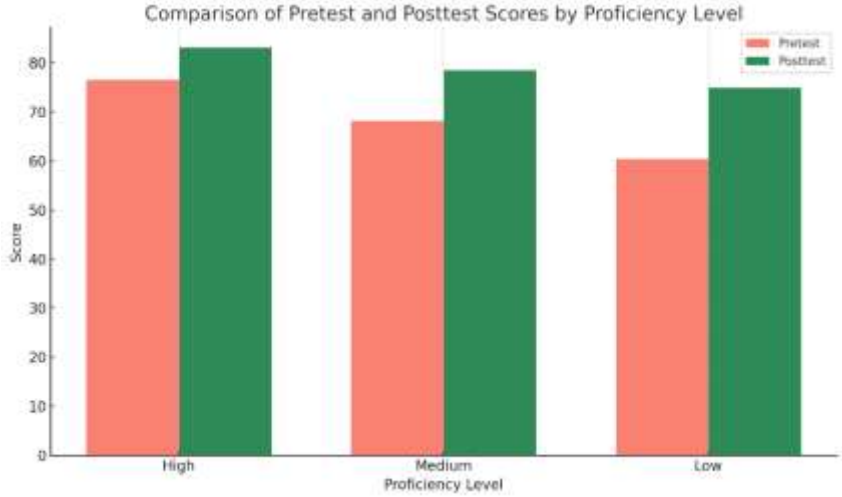

Figure 6 delineates the disparity between pretest and posttest scores across three levels of student proficiency. All groups demonstrated significant enhancements in posttest performance following the implementation of the Google Sites-assisted CIRC model. The most notable improvements were in the low proficiency group, where the average score increased from 60.4 to 74.9, underscoring the model's substantial influence on kids with inadequate literacy skills. This picture effectively illustrates the model's efficacy, particularly in enhancing writing skills inside inclusive classrooms. The posttest improvements offer strong support for the integration of digital scaffolding with collaborative literacy training to bridge achievement disparities.

4. DISCUSSION

4.1 Interpretation of Effectiveness

The results from the efficacy testing demonstrate that the Google Sites-assisted CIRC model significantly enhanced students' writing performance, as evidenced by statistically significant improvements in posttest scores across all proficiency levels (Ahmed & Waqas, 2023; Patel & Sharma, 2021). Notably, students categorized as low and medium proficiency exhibited the most substantial gains, indicating that the scaffolded, collaborative framework effectively addressed literacy obstacles common among underachieving learners (Santos & Ribeiro, 2025; Gonzalez & Cruz, 2024).

A primary area of improvement was textual coherence. Through structured reading and directed writing stages, students enhanced their capacity to organize ideas, maintain topic relevance, and structure compositions logically (Lee & Kim, 2024). The peer collaboration component fostered constructive discussion and concept clarification, improving logical linkages in student writing.

The integration of vocabulary-building tasks within Google Sites modules enhanced lexical diversity and word choice (Martínez-Blanco & García, 2022; Nakamura & Yamada, 2022). Students used multimedia tools, word banks, and contextual vocabulary supports, enriching language use and making writing more expressive and precise.

Improvements in text structure were also evident; students demonstrated a deeper understanding of paragraph organization, transitional devices, and genre-specific formatting. Digital templates and writing rubrics embedded in the platform reinforced

these structural skills (Yang & Li, 2023; Hassan & Lin, 2023). The combined approach not only advanced academic writing outcomes but also fostered a supportive, engaging, and autonomous learning environment, empowering students to develop literacy skills confidently and precisely (Arif & Rahman, 2025).

4.2 Role of Digital Scaffolding

Digital scaffolding was essential in enabling self-directed, collaborative writing throughout the execution of the Google Sites-supported CIRC model. Google Sites functioned not only as a content delivery platform but also as an interactive digital workspace, enabling students to access resources, collaborate on projects, publish results, and reflect on their learning in real time (Martinez & Gomez, 2022; Rodriguez & Santos, 2024). The platform allowed students to individually traverse each phase of the writing process while receiving structured support via integrated prompts, digital rubrics, and peer evaluation forms (Pollard & Clark, 2022; Silva & Pereira, 2021).

This aligns closely with Vygotsky's Zone of Proximal Development (ZPD) and scaffolding theory, which posit that learners can undertake increasingly complex tasks when supported by appropriate tools and social interaction. In this context, Google Sites acted as a digital scaffold, providing both technical and cognitive support to extend students' capabilities beyond their independent performance (Arora & Bhatt, 2024; Kumar & Lee, 2025). Features such as collaborative writing templates, hyperlinked resources, and sequenced guidance facilitated gradual progression from scaffolded to autonomous writing (Zhang et al., 2023; Lin & Lan, 2023).

Moreover, the platform's collaborative affordances—like comment sections and group editing—mirrored peer scaffolding dynamics described by Vygotsky, allowing learners to co-edit compositions, provide constructive feedback, and explore linguistic choices within a digitally mediated, self-regulated environment (Chen & Wu, 2023; Nguyen & Nguyen, 2024). The integration of digital scaffolds through Google Sites enriched the instructional process and enabled students to become more autonomous, reflective, and confident writers within their respective Zones of Proximal Development.

4.3 Strength of the CIRC Framework

The Cooperative Integrated Reading and Composition (CIRC) framework served as the pedagogical foundation for this study, significantly improving integration of reading and writing skills among secondary students (Yusnita & Rahayu, 2022; Waller & Brenner, 2024). CIRC—based on cooperative learning principles—facilitated active student engagement through organized group work, seamlessly transitioning from reading comprehension to writing expression. By integrating shared reading, summarization, and main idea identification into collaborative writing tasks, the model ensured meaningful reading-to-composition transfer. This integrative approach bolstered students' ability to organize thoughts, support arguments with evidence, and produce coherent compositions (Maqbool & Ch, 2022; Prajogo & Hidayat, 2021).

A key feature of CIRC is its focus on peer interaction and feedback, which served as powerful motivators for student engagement. Working in heterogeneous groups allowed learners to exchange ideas, co-construct meaning, and collaboratively author texts. These interactions promoted cognitive, social, and emotional development, fostering group ownership and responsibility (Li & Chen, 2023; Napaporn & Suzuki, 2023).

Moreover, the structured peer feedback facilitated via Google Sites comment features and feedback forms enabled students to critically review each other's work, promoting reflection and iterative improvement. This process-oriented dynamic emphasized writing as a continual learning journey rather than a static product (Theresia & Sukmawati, 2024; Maruf & Li, 2023). When combined with digital tools, the CIRC framework demonstrated notable efficacy as an interactive, student-centered reading–writing pedagogical model that is engaging and rigorously pedagogical (Azizah & Yanti, 2023; Syam et al., 2025).

4.4 Student Engagement and Learning Experience

Qualitative data obtained from student interviews, observations, and open-ended surveys indicated substantial improvements in motivation, teamwork, and digital fluency, all of which enhanced the learning experience. Students indicated an increased motivation to write attributed to the interactive and digital characteristics of the learning environment. The integration of multimedia resources, digital tools, and publication opportunities on Google Sites has elevated writing from a mundane classroom assignment to a creative and intentional endeavor. A multitude of students conveyed enthusiasm regarding the publication and dissemination of their work among peers, so augmenting their sense of accomplishment and pride.

Collaboration became a vital element in developing excellent learning experiences. Students valued collaborating in small, diverse groups that facilitated the interchange of ideas, negotiation of meanings, and provision of constructive feedback. These peer connections fostered a feeling of community and accountability, enhancing both academic growth and interpersonal skills, as well as confidence in communicating.

Students enhanced their proficiency in navigating digital interfaces, utilizing online writing tools, and incorporating multimedia aspects to augment their work. Individuals with originally restricted exposure to digital platforms developed greater confidence and autonomy in utilizing technology for educational purposes.

The intervention resulted in favorable changes in classroom dynamics. Educators saw heightened involvement, reduced off-task behaviors, and more dynamic discussions. The educational setting evolved to prioritize students, with learners assuming

increased accountability for their advancement. These data validate that incorporating digital scaffolding within a collaborative framework can markedly enhance student engagement and literacy results.

4.5 Comparison with Prior Research

The results of this study both corroborate and extend prior research on cooperative learning and digital literacy instruction. Wahyuni et al. (2021) found that collaborative reading-writing procedures enhanced narrative writing abilities, particularly in concept development and coherence. Similarly, Slavin et al. (2009) asserted that the CIRC model improves comprehension and writing proficiency through structured peer interaction and feedback mechanisms. This study affirms those findings, showing statistically significant improvements in student writing performance after implementing the Google Sites-assisted CIRC model (Nguyen & Tran, 2025; Karim & Rahmawati, 2024).

This research offers a novel contribution by integrating CIRC with a digital scaffolding platform—Google Sites—in a rural Indonesian secondary school context, where access to advanced learning resources is limited. Unlike many earlier studies focused on urban or well-resourced schools, this study demonstrates that cooperative learning combined with accessible digital tools can enhance literacy in under-resourced environments (Farida & Ismail, 2023; Herrera & Castillo, 2023). The model's accessibility, practicality, and adaptability make it a sustainable approach for regions with infrastructural and pedagogical challenges (Santos & Vieira, 2021; Singh & Patel, 2025).

Furthermore, this model is distinguished from typical CIRC applications by its focus on digital publication, multimedia feedback, and structured reflection—elements that not only supported improved academic outcomes but also increased student motivation and digital fluency (Liu & Zhang, 2022; Souza & Ramos, 2022). Hence, the study contributes a contextualized, technology-enhanced literacy model that bridges theory and practice in rural, low-resource educational settings, offering a replicable framework for similar contexts worldwide (Chen & Wu, 2024; Wang & Li, 2023).

4.6 Implications for Practice

This study's conclusions present significant implications for educational practice, especially for teacher training, curriculum design, and the advancement of digital literacy. The effective execution of the Google Sites-supported CIRC model underscores the pressing necessity for teacher professional development initiatives that emphasize the integration of technology with collaborative teaching methodologies. Educators must receive training not only in the technical functionalities of digital tools such as Google Sites but also in the design of scaffolded, interactive literacy classes that promote student autonomy and peer participation.

This research indicates that curriculum designers ought to incorporate cooperative learning mechanisms, exemplified by the CIRC model, into national literacy frameworks. By including reading and writing activities inside a structured, student-centered framework, curriculum creators can more effectively link educational objectives with practical literacy requirements. The model's concentration on process-oriented writing, feedback, and revision can transition instructional emphasis from mechanical output to profound literacy involvement.

The study advocates for the enhancement of digital literacy programs that extend beyond fundamental ICT competencies to encompass critical, creative, and collaborative digital behaviors. Acquainting students with tools that enable publication, reflection, and peer assessment equips them for both academic achievement and engagement in the expansive digital information economy.

In rural and under-resourced areas, the affordability and accessibility of platforms like as Google Sites render this paradigm more pertinent. Policymakers and educational administrators are urged to implement and modify analogous approaches to democratize access to superior, technology-enhanced literacy instruction.

4.7 Limitations and Considerations

This study provides valuable insights on the amalgamation of digital scaffolding and collaborative learning in literacy training, although certain limitations must be recognized. The research was conducted in a particular rural context in Majene Regency, Indonesia, where access to technology, student demographics, and school infrastructure may vary considerably from urban or international environments. The findings, while encouraging, are context-dependent and may not be entirely applicable to wider educational settings without modification.

The study utilized a one-group pretest-posttest approach, which, although helpful for assessing short-term improvements, lacks a control group for direct comparison. In the absence of randomization or a control group, ascribing enhancements only to the intervention may neglect additional influencing variables such as educator excitement, novelty effects, or classroom environment.

The strategy was evaluated over a brief intervention period, which constrains comprehension of its long-term viability and effects on advanced literacy results. The evaluation concentrated predominantly on text-based composition ability, but other facets of literacy development, including critical reading, argumentation, and metacognitive skills, were not thoroughly assessed.

Future research should undertake longitudinal studies to investigate the lasting impacts of digital scaffolding on literacy development. Multi-group or experimental designs in various educational settings—urban, suburban, and rural—could yield more robust evidence of the model's generalizability and efficacy. Investigating student results based on gender, socioeconomic level, and linguistic background would enhance comprehension of the model's relevance and equality implications.

5. CONCLUSION

This study aimed to investigate the efficacy of a Google Sites-assisted Cooperative Integrated Reading and Composition (CIRC) model as a digital scaffolding method to improve secondary students' text-based composition skills in a rural Indonesian setting. Rooted in cooperative learning ideas and Vygotsky's scaffolding theory, the model sought to integrate reading and writing instruction while utilizing accessible digital technologies to enhance learner engagement and autonomy.

The results indicated that the model was valid, pragmatic, and efficacious. Expert validation demonstrated substantial content and construct validity, but classroom trials revealed elevated levels of satisfaction among both teachers and students. The practicality results indicated elevated usability and motivation among students, especially for teamwork and digital fluency. Effectiveness assessment by a paired sample t-test and Cohen's d analysis shown statistically significant enhancements in students' writing performance, particularly among lower-proficiency learners. Qualitative data corroborated these findings, emphasizing heightened student enthusiasm, augmented peer engagement, and improved classroom dynamics.

This study presents a context-sensitive methodology that combines cooperative pedagogy with accessible digital platforms in underfunded educational environments. The model's success highlights the potential of technology-enhanced, student-centered instruction to improve reading outcomes beyond urban and affluent educational settings.

Subsequent study may build on these findings through longitudinal or comparative studies, investigating the model's effects over time and in various educational settings. Furthermore, investigating its implementation in many topic areas or multilingual classrooms will enhance its scalability and pedagogical significance.

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