



Enhancing Students' Reading Literacy through the Implementation of Reading and Writing Across the Curriculum (RWAC) Using *BukuAku*

Amy Theresia Sipayung^{1✉}, Asep Herry Hernawan², Ahmad Fajar Fadlillah³

Universitas Pendidikan Indonesia,

Affiliation Address: Jl. Dr. Setiabudi No.229, Isola, Kec. Sukasari, Kota Bandung, Jawa Barat 40154

✉Corresponding Author: amytheresia@upi.edu

Abstract

This study evaluated the effectiveness of BukuAku, an interactive digital library application, in enhancing elementary school students' reading literacy through the Reading and Writing Across the Curriculum (RWAC) approach. As digital learning tools become increasingly integral in early education, this study aimed to assess the impact of BukuAku on students' reading comprehension using a quantitative research design. A quasi-experimental one-group pretest–posttest design was implemented involving 30 third-grade students over a four-month intervention period (January–April 2025). Two main instruments were employed in this study. The first instrument was the Lumina Testing Service (LTS), a Lexile-based quantitative reading assessment tool that is widely used internationally and supported by documented validity and reliability. The second was BukuAku, a digital library that provided leveled digital texts, audio narration, and quizzes to support the learning process. Reading proficiency was measured using the LTS before and after the intervention. Statistical analysis using a paired samples t-test revealed a significant increase in students' Lexile scores, from a mean of 700.17 (SD = 26.375) in the pretest to 832.33 (SD = 39.277) in the posttest. These results demonstrate a substantial improvement in reading comprehension following the intervention. The findings support the efficacy of integrating digital literacy tools with cross-curricular reading and writing approaches to strengthen reading comprehension in early grades. This study contributes to the empirical literature on educational technology integration and highlights the value of structured, interactive literacy interventions. Future research is recommended to explore long-term impacts and broader implementation across diverse educational context.

Keywords: digital library, reading literacy, elementary students, RAWAC, Lexile Framework

Peningkatan Literasi Membaca Siswa melalui Implementasi *Reading and Writing Across the Curriculum* (RAWAC) Menggunakan BukuAku

Abstrak

Penelitian ini mengevaluasi efektivitas BukuAku, sebuah aplikasi perpustakaan digital interaktif, dalam meningkatkan literasi membaca siswa sekolah dasar melalui pendekatan *Reading and Writing Across the Curriculum* (RWAC). Seiring dengan semakin terintegrasinya teknologi digital dalam pendidikan dasar, penelitian ini bertujuan untuk menilai dampak penggunaan BukuAku terhadap pemahaman membaca siswa melalui pendekatan kuantitatif. Desain penelitian yang digunakan adalah kuasi-eksperimen dengan model satu kelompok *pretest–posttest*, melibatkan 30 siswa kelas III selama empat bulan intervensi (Januari–April 2025). Dua instrumen utama digunakan dalam studi ini. Instrumen pertama adalah Lumina Testing Service (LTS), sebuah alat asesmen membaca kuantitatif berbasis Lexile yang digunakan secara luas di tingkat internasional dan didukung oleh validitas serta reliabilitas yang telah terdokumentasi. Instrumen kedua adalah BukuAku, sebuah perpustakaan digital yang menyediakan teks digital berjenjang, narasi audio, dan kuis untuk mendukung proses pembelajaran. Kemampuan membaca siswa diukur menggunakan LTS sebelum dan sesudah intervensi. Analisis statistik menunjukkan peningkatan signifikan skor Lexile, dari nilai rata-rata 700,17 (SD = 26,375) pada *pretest* menjadi 832,33 (SD = 39,277) pada *posttest*. Temuan ini menunjukkan peningkatan substansial dalam kemampuan membaca setelah intervensi. Hasil penelitian ini mendukung efektivitas integrasi teknologi literasi digital dengan pendekatan membaca dan menulis lintas kurikulum dalam meningkatkan pemahaman membaca pada jenjang awal. Studi ini memberikan kontribusi terhadap bukti empiris penggunaan teknologi pendidikan di kelas dasar dan menekankan pentingnya intervensi literasi digital yang terstruktur. Penelitian lanjutan direkomendasikan untuk mengeksplorasi dampak jangka panjang serta implementasi di konteks pendidikan yang lebih luas dan beragam.

Keywords: perpustakaan digital, literasi membaca, siswa sekolah dasar, RAWAC, Kerangka Lexile

INTRODUCTION

Reading literacy is widely acknowledged as a fundamental cognitive skill that serves as the cornerstone for academic achievement, critical thinking, and lifelong learning. It enables individuals to access, interpret, and evaluate information across a variety of contexts, thereby fostering active participation in educational, social, and economic spheres. At the global level, literacy proficiency is increasingly recognized not only as a personal asset but also as a vital prerequisite for sustainable development and social equity, as emphasized by international bodies such as [UNESCO \(2017\)](#). The ability to read effectively is linked to broader societal outcomes including reduced poverty, improved health, and enhanced civic engagement, underscoring the urgency of literacy enhancement worldwide.

Despite this global consensus, many countries continue to face significant challenges in raising literacy levels among their student populations. Indonesia, a diverse archipelagic nation with complex educational landscapes, exemplifies these challenges. The 2022 Programme for International Student Assessment (PISA) results starkly reveal that Indonesian students ranked 70th out of 81 participating countries in reading literacy, with scores substantially below the OECD average ([OECD, 2023](#)). This persistent underperformance points to systemic issues that extend beyond mere access to education, encompassing factors such as curriculum design, instructional quality, resource availability, and sociocultural influences. The low ranking signals an urgent call for comprehensive strategies to better understand and address the multifaceted barriers impeding literacy development across the Indonesian education system.

A growing body of research identifies several key obstacles contributing to Indonesia's literacy challenges. Limited availability and equitable distribution of high-quality reading materials remains a significant barrier, particularly in rural and under-resourced schools ([Firmansyah, 2023](#)). Moreover, literacy instruction has traditionally been compartmentalized within language classes, with minimal integration across other subject areas, resulting in missed opportunities to reinforce reading and writing skills in meaningful contexts ([Mangvwat & Meshak, 2022](#); [Aisyah, 2022](#)). Pedagogical approaches often rely heavily on rote memorization and teacher-centered practices, which inadequately foster critical thinking, engagement, and higher-order comprehension skills necessary for the 21st century ([Nasihah & Tabroni, 2022](#)). Although the Indonesian Ministry of Education has launched various literacy initiatives, these have largely targeted isolated reading programs, without fully leveraging the potential of cross-curricular literacy development or innovative instructional technologies.

Considering these challenges, recent educational discourse advocates for more holistic and integrated pedagogical frameworks that situate literacy instruction across the curriculum, thus embedding reading and writing within authentic, disciplinary contexts. One such approach gaining prominence is Reading and Writing Across the Curriculum (RWAC). RWAC encourages the systematic incorporation of literacy strategies into all subject areas, including science, social studies, and mathematics, to support deeper understanding, critical analysis, and meaningful knowledge construction ([Henson, 2015](#); [Vaughn et al., 2017](#)). By promoting multiliteracy, the ability to interpret and create meaning across diverse formats and disciplines, RWAC aligns with contemporary educational goals emphasizing cognitive engagement and lifelong learning skills. This approach not only broadens the scope of literacy instruction but also enhances students' ability to transfer literacy skills to varied academic and real-world contexts, as supported by previous research highlighting the benefits of cross-disciplinary literacy practices in promoting knowledge transfer and cognitive flexibility ([Shanahan & Shanahan, 2008](#); [Moje et al., 2004](#)).

Complementing pedagogical innovations like RWAC, digital literacy tools have emerged as powerful facilitators of personalized and adaptive learning experiences. BukuAku, an Indonesian digital library platform employing the Lexile Framework, exemplifies such technological advancement ([BukuAku, 2022](#)). The Lexile Framework provides a scientifically validated method for matching readers with texts at appropriate difficulty levels, thereby scaffolding individual reading development ([Wu & Chen, 2020](#); [Guo et al., 2020](#); [Smith et al., 2016](#)). BukuAku's platform offers an extensive collection of leveled reading materials that can be tailored to the diverse needs of students, fostering motivation and sustained engagement through adaptive pathways. Integrating such digital tools within RWAC frameworks holds significant promise for addressing literacy gaps, especially in heterogeneous classrooms and resource-constrained environments.

Despite increasing theoretical and pedagogical support for integrating Reading and Writing Across the Curriculum (RWAC) with adaptive digital platforms, empirical studies examining their combined use in Indonesian primary education remain limited. Prior research has typically addressed these strategies in isolation. The concept of disciplinary literacy, reading and writing aligned with the epistemic practices of

specific fields has gained scholarly attention (Shanahan & Shanahan, 2008). Digital reading platforms with personalized features like real-time feedback and tailored content have also been found to significantly enhance engagement and comprehension (Huang et al., 2022). Moreover, digital storytelling offers multidimensional literacy benefits across cognitive, affective, linguistic, and reflective domains (Wu & Chen, 2020). However, no prior study has examined how RWAC and adaptive platforms can be integrated into a cohesive literacy model in the Indonesian context.

Additionally, a longitudinal study on kindergarten children revealed that independent literacy practices at home, such as self-initiated reading and writing, were stronger predictors of early writing outcomes than direct parental instruction (Guo et al., 2020). These findings suggest the value of autonomous literacy engagement for fostering foundational skills. Yet, how such independent engagement interacts with structured RWAC and technology-enhanced instruction in diverse, multilingual primary classrooms remains underexplored. Addressing this dual gap is critical for developing inclusive and evidence-based literacy programs that promote equity and excellence in Indonesian education.

Guided by this context, the present study seeks to examine the impact of implementing RWAC supported by BukuAku on the reading literacy outcomes of Indonesian primary school students. The research hypothesizes that embedding cross-curricular literacy instruction with personalized digital reading resources will significantly enhance students' comprehension and writing skills. It aims to contribute to the growing body of evidence supporting multiliteracy pedagogies that foster critical thinking, cognitive engagement, and learner autonomy—competencies essential for academic success and lifelong learning in the digital era.

The theoretical framework underpinning this study is grounded in Vygotsky's sociocultural theory, which emphasizes the fundamental role of social interaction, scaffolding, and culturally mediated tools in cognitive development (Vygotsky, 1978). RWAC operationalizes these principles by fostering collaborative learning environments and engaging students in meaningful literacy tasks that traverse disciplinary boundaries, thereby promoting metacognitive awareness and deeper comprehension (Moje et al., 2004; Shanahan & Shanahan, 2008). Concurrently, the incorporation of adaptive digital tools like BukuAku reflects constructivist learning theories, offering individualized scaffolding that adapts dynamically to learners' evolving proficiency levels, thereby supporting learner-centered instruction. Contemporary literacy scholarship also highlights the increasing importance of multimodal literacy, wherein students interact with diverse semiotic resources such as texts, images, audio, and interactive media to construct meaning and solve complex problems (Jewitt, 2008; Leu et al., 2013). This multimodal engagement is critical for preparing students to navigate the complex communication demands of the 21st century.

In sum, this study addresses a pressing educational challenge in Indonesia by investigating an innovative, blended literacy pedagogy that integrates RWAC with adaptive digital reading resources. Beyond its immediate practical implications, it also contributes to the theoretical discourse on effective literacy instruction in increasingly digital and interconnected learning environments. The findings are expected to provide actionable insights for educators, curriculum developers, and policymakers seeking to enhance literacy education and promote equitable learning opportunities in Indonesia and comparable contexts globally.

METHODS

This study employed a quantitative research approach using a pre-experimental one-group pretest-posttest design. This design was chosen to evaluate the effectiveness of the BukuAku application in enhancing reading literacy skills among elementary school students. In this design, measurements were taken before and after the intervention on the same group of participants. Although it does not include a control group, this approach was selected due to contextual considerations such as limited resources and the study's focus on the initial phase of development and evaluation of the application's effectiveness.

The researchers acknowledge that this design has limitations in internal validity, including potential influences from external factors (history), testing effects, and maturation of participants over time. To minimize these threats, several measures were implemented to ensure consistency during the intervention, such as standardized time allocation for application use, uniform guidance, and consistent instructions delivered to all participants. The intervention was grounded in the Reading and Writing Across the Curriculum (RWAC) approach, as described by Henson (2015), which emphasizes integrating reading and writing activities to strengthen literacy learning. This approach was selected because it facilitates deeper reading comprehension through the process of written expression.



The participants consisted of 30 third-grade elementary students who were selected through purposive sampling. The inclusion criteria required that students have access to digital devices such as tablets, laptops, or smartphones, and that they were willing to participate in the reading and writing program throughout the study period. The participants were drawn from several private elementary schools, with ages ranging from 8 to 9 years old. The choice of third-grade students was based on the assumption that, at this stage, they have acquired sufficient basic reading skills to engage effectively with a digital literacy intervention.

Two main instruments were employed in this study. The first was the Lumina Testing Service (LTS), a Lexile-based quantitative reading assessment tool widely used internationally with documented validity and reliability. LTS was administered twice, before and after the intervention, to measure changes in students' reading abilities quantitatively. The second instrument was the BukuAku application itself, an interactive digital library developed specifically for this intervention. BukuAku offers a variety of children's stories in digital text form, enriched with features such as Read-to-Me audio narration, an interactive dictionary, comprehension quizzes, and a digital reward system. In addition to reading, students were encouraged to write book reviews or personal reflections after completing each story, as part of the RWAC approach aimed at reinforcing reading comprehension through writing.

The research was conducted from January to April 2025, beginning with a pre-test phase in January during which students completed the LTS assessment online under the supervision of their classroom teachers to establish baseline reading proficiency. During the intervention period from January to April, students were scheduled to read at least one book per day using the BukuAku app. After finishing each reading, they wrote a book review or personal reflection to deepen their understanding through writing. Classroom teachers provided ongoing support and supervision to ensure students completed the tasks appropriately. At the end of the study in April, the students took the LTS post-test, identical to the pre-test, to assess any improvement in reading literacy.

Data collected from the pre- and post-tests were analyzed using SPSS software. Initially, the Kolmogorov-Smirnov test was applied to verify the normality of the data distribution. Subsequently, a paired sample t-test was conducted to determine the statistical significance of differences in students' reading scores before and after the intervention. A significance level of 0.05 was used to interpret the results.

RESULTS AND DISCUSSION

Students' Reading Literacy Level Before Intervention

The results of the pre-test measuring reading literacy ability of 30 elementary school students before the intervention are presented in Table 1.

Table 1. Descriptive Statistics of Pre-test Results on Reading Literacy Ability

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test	30	650L	750L	700.17	26.375

The pre-test reading literacy scores of 30 elementary school students ranged from 650L to 750L, with a mean of 700.17L and a standard deviation of 26.375 (Table 1). This 100L spread reflects a notable variation in reading proficiency, although the relatively low standard deviation suggests that most scores clustered near the mean. Such distribution provides a reliable empirical baseline for evaluating the effectiveness of subsequent interventions. These initial findings point to the necessity of exploring the factors contributing to this performance range.

At the lower end, a score of 650L represents a transitional literacy stage, where comprehension is generally confined to simple sentence structures and limited vocabulary (MetaMetrics, 2020). Learners at this level typically require extensive scaffolding to navigate unfamiliar or complex texts. In contrast, the highest score of 750L corresponds to the ability to interpret complex syntax and abstract concepts. This contrast illustrates the breadth of reading abilities that instructional strategies must address simultaneously.

Building on this observation, variability in reading proficiency is not unique to this cohort but reflects a well-documented trend in primary education (Aisyah, 2022). Such diversity necessitates teaching approaches that respond effectively to both struggling and advanced readers. Without tailored instruction,

higher-level students risk stagnation, while lower-level students may lose motivation. Thus, implementing adaptive methods becomes crucial for equitable literacy development.

One significant factor underlying the low literacy scores is the limited availability of reading materials that match students' proficiency levels. Many elementary schools rely heavily on general or compulsory textbooks, offering few levelled reading resources. This lack of access restricts students' opportunities to engage with progressively challenging texts. Consequently, consistent and sustainable literacy growth becomes difficult to achieve.

Furthermore, the problem is compounded by a mismatch between text difficulty and students' reading abilities. Texts that are overly challenging often cause frustration, while excessively simple materials fail to stimulate cognitive growth. Such misalignment can lead to a plateau in literacy skills, preventing meaningful advancement. To address this, schools require curated reading selections guided by Lexile levels or similar indicators.

Pedagogical practices also contribute to these outcomes, particularly when teachers limit reading instruction to oral reading without incorporating comprehension strategies. In many cases, techniques such as prediction, inference, or targeted information retrieval are absent from classroom routines. This omission encourages mechanical reading without deep engagement with meaning. A shift toward prioritising comprehension quality over reading quantity is therefore essential.

In addition, some students develop habits of reading hastily, focusing on task completion rather than text understanding. This behaviour is often reinforced by assessment systems that prioritise speed over comprehension depth. The absence of a school-wide culture that values reflective reading exacerbates this issue. As a result, decoding ability may exist without the corresponding development of higher-order literacy skills.

To counter these challenges, the Reading and Writing Across the Curriculum (RWAC) framework, as conceptualised by [Henson \(2015\)](#), offers a promising approach. By embedding literacy tasks across all subject areas, RWAC ensures that reading and writing skills are developed in varied and meaningful contexts. This cross-curricular integration promotes skill transfer and sustained engagement. Importantly, it positions literacy as a shared responsibility across disciplines.

The adaptability of RWAC can be further enhanced through integration with the BukuAku digital platform. BukuAku provides Lexile-leveled materials that ensure learners access texts aligned with their proficiency ([BukuAku, 2022](#)). Its interactive quizzes foster active engagement and strengthen comprehension via retrieval practice. This synergy between content suitability and task design supports both lower- and higher-achieving students.

Moreover, BukuAku's features, such as multilingual resources, diverse themes, and cloud-based access, make it particularly suitable for diverse educational environments. These capabilities allow for consistent literacy engagement in both resource-rich and resource-constrained contexts. The platform's scalability also reflects the growing global trend toward blended and technology-supported learning. This positions it as a versatile tool for sustained literacy improvement.

From a theoretical perspective, BukuAku aligns with literacy principles emphasising the reciprocal relationship between reading and writing. Activities like book reviews encourage students to process content actively, reinforcing comprehension and expressive skills simultaneously. Such tasks also promote higher-order thinking through evaluative and interpretive responses. Consequently, the platform addresses both foundational and advanced literacy competencies in an integrated manner.

Given the pre-test findings, differentiated literacy activities within the RWAC model are pedagogically justified. Stronger readers can be extended through analytical writing assignments, while developing readers receive scaffolded support tailored to their needs. This differentiation ensures ongoing engagement and measurable progress for all learners. Such an approach aligns with inclusive education principles identified in prior research ([Henson, 2015](#); [Aisyah, 2022](#)).

In sum, the combined application of RWAC and BukuAku presents an evidence-based, contextually relevant strategy for improving primary school literacy outcomes. Personalised reading pathways ensure that each student engages with appropriately challenging materials, while embedded writing tasks foster deeper comprehension and cross-curricular skill application. Together, these elements create a comprehensive and sustainable model for literacy development.

Students' Reading Literacy Level After the Intervention

The results of the post-test measuring reading literacy ability of 30 elementary school students after the intervention are presented in Table 2.



Table 2. Descriptive Statistics of Post-test Results on Reading Literacy Ability

	N	Correlation	Maximum	Mean	Std. Deviation
Pre-Test & Post-Test	30	.973	890L	832.33	39.277

The data in the table indicate that the students' average Lexile score in the pre-test was 700.17L, with the lowest score at 650L and the highest at 780L. Following the implementation of the BukuAku application, there was a substantial and statistically meaningful improvement. The average score rose by 132.16L, with the minimum post-test score increasing to 750L and the mean reaching 832.33L. These results suggest that all students experienced measurable progress in their reading literacy levels.

No student remained below the transitional reading level after the intervention, which highlights the positive impact of BukuAku on foundational literacy. The notable increase in the minimum score is a strong early indicator of the application's effectiveness. This finding also demonstrates that students who had previously been among the lowest achievers managed to improve significantly. Such progress reflects the inclusive design of the program, which was able to support learners across a wide range of proficiency levels.

One key factor contributing to this improvement was the decision to provide students with their baseline Lexile scores before the intervention commenced. This practice fostered metacognitive awareness and encouraged intrinsic motivation to pursue higher performance. According to Zimmerman (2002), self-awareness of academic standing forms a critical foundation for self-regulated learning. By knowing their starting point, students could monitor their growth and establish realistic objectives throughout their engagement with BukuAku.

Teacher facilitation also played a pivotal role in optimizing the benefits of the application. Educators carefully matched reading materials to each student's Lexile level, maintaining an optimal balance between challenge and accessibility. Texts that were too simple risked causing disengagement, while those that were too difficult could lead to frustration. This instructional strategy is consistent with Vygotsky's concept of the zone of proximal development, which emphasizes that learning is most effective when challenges are slightly above the learner's current ability but attainable with guidance.

The gamification elements of BukuAku, particularly the badge reward system, further contributed to enhancing student motivation. Students received badges upon completing reading challenges, which acted as positive reinforcement for their efforts. This form of recognition helped students associate reading with achievement and satisfaction. The balance between enjoyment and academic goals sustained their engagement over the course of the intervention.

The reading challenge feature provided a structured, goal-oriented framework that encouraged consistent reading habits. Each completed challenge was rewarded with a visible digital badge, fostering a sense of accomplishment and progress. This approach aligns with Self-Determination Theory, which asserts that recognition and achievement fulfil the psychological needs for competence, autonomy, and relatedness (Deci & Ryan, 2000). Moreover, Achievement Goal Theory suggests that such milestones promote mastery-oriented behaviors, motivating students to focus on personal growth and skill development rather than merely outperforming peers (Elliot & McGregor, 2001). By embedding these motivational principles, BukuAku effectively nurtured sustained reading engagement and exploration of diverse texts.

Another essential feature of BukuAku was the post-reading quizzes designed to assess comprehension. This activity transformed reading from a passive to an active learning process. The quizzes served as formative assessments, offering immediate feedback to both students and teachers. When applied consistently, such assessments help learners identify weaknesses and adjust their strategies to enhance understanding.

The reflective writing tasks that followed each reading session further deepened student engagement. Learners were encouraged to articulate their opinions, interpretations, or critiques of the texts they had read. Such activities activate higher order thinking skills, including analysis, synthesis, and evaluation, which Henson (2015) identifies as central to the concept of writing to learn. Through writing, students moved beyond simple recall and developed a more nuanced comprehension of the material.

The overall findings indicate that BukuAku holds strong potential as a tool for enhancing reading literacy in elementary education. This aligns with previous research suggesting that integrating technology

into teaching enriches learning experiences and strengthens academic outcomes (Quraishi et al., 2023). The incorporation of the Reading and Writing Across the Curriculum approach amplified the intervention's impact by connecting reading comprehension with reflective writing. Such integration promoted literacy practices that extend beyond basic decoding skills.

Henson (2015) argues that writing to learn is a powerful tool for helping students internalize and apply knowledge from their reading. Post-reading writing tasks not only consolidate comprehension but also cultivate critical thinking and knowledge construction. These practices encourage learners to engage deeply with texts and connect ideas in meaningful ways. The reciprocal relationship between reading and writing thus creates a reinforcing cycle of literacy development.

Despite the overall positive outcomes, the data reveal an increase in variability among students' performances. The standard deviation in the post-test scores was 39.277 compared with 26.375 in the pre-test. While many students demonstrated substantial gains, some exhibited more modest improvements. This variability may be explained by factors such as prior literacy levels, personal motivation, and differences in engagement.

This variation underlines the importance of differentiated instructional strategies in digital literacy interventions. Even when a tool like BukuAku proves broadly effective, individual progress can vary depending on usage intensity and initial skill level. Teachers must provide additional scaffolding for students who advance more slowly, while ensuring that advanced readers continue to be challenged. Differentiated approaches maximize learning opportunities for all students.

In conclusion, this study provides empirical evidence that BukuAku, when implemented within the RWAC framework, can significantly improve reading literacy among elementary school students. The combination of technology, reading, and writing offers a comprehensive literacy experience that accommodates a wide range of learner profiles. These findings contribute to the growing body of literature advocating for integrated, technology-enhanced literacy instruction. Further studies should examine the long-term sustainability of these gains and investigate the influence of contextual factors such as teacher facilitation and home literacy environments.

Improvement in Students' Reading Literacy Skills Following the Use of the BukuAku Application

The analysis results indicate that the correlation coefficient (r) between the pre-test and post-test scores was 0.973, with a significance value (p) of less than 0.001, for both one-sided and two-sided tests, as presented in Table 3.

Table 3 Paired Sample Correlation Test

	N	Correlation	Significance	
			One-Sided p	Two-Sided p
Pre-Test & Post-Test	30	.973	890L	832.33

The data presented above indicate that the implementation of BukuAku made a significant contribution to improving students' reading literacy skills. The strong positive correlation between pre-test and post-test scores ($r = 0.973$) reflects consistent progress among almost all participants. Furthermore, the very low level of significance ($p < 0.001$) suggests that the observed improvement was unlikely to occur by chance, but rather as a direct outcome of the intervention implemented through the BukuAku platform. These findings reinforce the assertion that adaptive technology integration can be an effective strategy for literacy development in primary education.

An analysis of score distribution reveals variability in students' progress. The increase in standard deviation from the pre-test ($SD = 26.375$) to the post-test ($SD = 39.277$) indicates a wider dispersion of results after the intervention. This suggests that, while the overall trend points to improvement, not all students benefited equally from the program. Such variability warrants further investigation into the factors influencing individual differences in learning outcomes.

Potential factors contributing to disparities in student progress include intrinsic motivation, consistency in using the application, access to digital devices at home, and initial reading proficiency. Students with stronger baseline reading skills may have been better positioned to utilise BukuAku's features to enhance text comprehension. Conversely, those with weaker initial abilities might require

additional interventions such as guided support or scaffolded resources. This underscores the necessity for adaptive and differentiated instruction (Tomlinson, 2014).

From a pedagogical perspective, these variations in learning outcomes align with Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD), which emphasises the need for targeted scaffolding to move learners toward higher levels of competence. Within BukuAku, adaptive features can be calibrated to each student's ZPD, ensuring that reading tasks are challenging yet achievable. This personalised approach supports students starting from different proficiency levels, enabling them to make steady progress. Without such scaffolding, lower-proficiency learners risk disengagement, while advanced learners may fail to be sufficiently challenged.

Moreover, the design of BukuAku can be interpreted through the lens of cognitive load theory (Sweller, 2010), which recommends minimising extraneous processing while maximising meaningful learning. Features such as adjustable text complexity, built-in glossaries, and progress tracking dashboards help reduce unnecessary cognitive barriers to reading comprehension. By lowering extraneous cognitive load, students can focus their mental resources on constructing meaning from texts. This is particularly valuable for struggling readers, who may otherwise face difficulties when exposed to unstructured or overly complex materials.

One motivational strategy proven to be effective is the implementation of digital badges within BukuAku. These badges are awarded when students complete specific reading challenges, such as achieving weekly reading targets or comprehending texts of a certain difficulty level. This gamification approach fosters active engagement, instils a sense of achievement, and enhances learning motivation. Consequently, students' motivation is driven not only by academic achievement but also by the symbolic recognition they receive.

In addition to badges, reading challenges also play an important role in driving student engagement. These challenges typically involve time-bound or volume-based reading targets that can be undertaken individually or collaboratively. Through healthy competition, students are encouraged to maintain reading consistency while improving their comprehension skills. Such strategies have been shown to foster long-term reading habits, which are critical indicators of sustained literacy.

These findings highlight the importance of differentiated instruction, even within the framework of digital literacy interventions. Not all learners respond to technology-based programs uniformly; therefore, instructional design should accommodate diverse needs and contexts. Future research should integrate qualitative data, such as student interviews, engagement logs, and teacher observations, to enrich quantitative analyses. This would provide deeper insights into how individual learner characteristics and environmental variables shape literacy outcomes.

The present study aligns with Henson's (2015) assertion that integrating reading and writing in instructional practice cultivates deeper comprehension. Writing serves not only to reinforce textual understanding but also as a framework for reflection, analysis, and synthesis. The use of levelled texts, audio narration, and reflective writing prompts in BukuAku aligns with this integrated approach. Together, these features enable the balanced development of receptive and expressive literacy skills among primary school students.

Teacher involvement emerged as another critical factor in ensuring the effectiveness of technology-based programs such as BukuAku. Teachers who actively monitor students' progress and provide personalised feedback are better able to guide learners in selecting materials that match their proficiency levels. This practice not only optimises the use of the platform but also strengthens pedagogical relationships between teachers and students. These findings are consistent with Moltudal et al. (2022), who emphasised the pivotal role of pedagogical expertise in maximising the potential of educational technology.

The effectiveness of this approach is further supported by recent empirical studies. Campbell et al. (2022) reported that students using adaptive reading technology achieved greater gains in comprehension and vocabulary acquisition. These findings underscore the value of personalised learning tools in literacy development. Moltudal et al. (2022) also highlighted the importance of sustained professional development for teachers to fully leverage the potential of literacy-oriented digital platforms in classroom practice.

Nevertheless, caution is warranted when interpreting these findings due to the methodological limitations of this study. The absence of a control group limits the strength of causal inferences, and the relatively short intervention period restricts insights into the long-term effects of BukuAku on literacy growth. Future research should employ more rigorous experimental designs, involve more diverse

demographic samples, and track literacy progress over extended periods. Such efforts would contribute to building a stronger empirical foundation for scalable and inclusive digital literacy interventions.

CONCLUSION

This study underscores the effectiveness of integrating the Reading and Writing Across the Curriculum (RWAC) approach with the BukuAku digital platform in improving elementary students' reading literacy by engaging them in reflective, cross-disciplinary literacy practices within a technology-enhanced environment. Through the strategic use of digital reading materials and structured writing tasks such as book reviews and personal reflections, students demonstrated not only improved reading comprehension but also increased motivation and cognitive engagement, which are critical for fostering higher-order literacy skills in the 21st century. The findings affirm that embedding RWAC principles into digital platforms like BukuAku holds considerable promise in transforming conventional literacy instruction into more interactive, student-centered, and contextually meaningful learning experiences.

From a broader educational policy perspective, the integration of such technology-based literacy programs can serve as a scalable and inclusive strategy to address literacy disparities in diverse and multilingual classroom settings. Nevertheless, this study is limited by its small sample size and short intervention period, which may affect the generalizability of the results and the ability to observe sustained learning outcomes over time. Future research is encouraged to adopt longitudinal and multi-site designs to examine the long-term impact and contextual adaptability of BukuAku and similar platforms across different educational levels and subject areas. Ultimately, the continued exploration of RWAC-informed digital interventions is essential to building a stronger empirical foundation for inclusive, innovative, and future-oriented literacy education.

Beyond improvements in reading proficiency, the integration of RWAC with digital platforms like BukuAku holds long-term potential to foster a wider range of 21st-century competencies. These include critical thinking through reflective writing tasks, collaborative learning via shared reading activities, and enhanced metacognitive skills as students monitor their own comprehension and learning strategies. Such outcomes are central to deeper learning and lifelong literacy development. Future studies should examine these broader impacts using mixed-method approaches to better capture the cognitive and social dimensions of digitally supported, cross-curricular literacy interventions.

REFERENCES

- Aisyah, & F, T. (2022). Literasi digital untuk meningkatkan minat baca siswa SMA pada pembelajaran daring. *IQRA': Jurnal Perpustakaan Dan Informasi*, 16(1), 18–29.
- BukuAku. (2022). *Landlord*. BukuAku. <https://bukuaku.id/id/landlord>
- Campbell, L. O., Howard, C., Lambie, G. W., & Gao, X. (2022). The efficacy of a computer-adaptive reading program on grade 5 students' reading achievement scores. *Education and Information Technologies*, 27(6), 8147–8163. <https://doi.org/10.1007/s10639-022-10953-5>
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Elliot, A. J., & McGregor, H. A. (2001). A 2×2 achievement goal framework. *Journal of Personality and Social Psychology*, 80(3), 501–519. <https://doi.org/10.1037/0022-3514.80.3.501>
- Firmansyah, A. (2023). Kaperpusnas: Koleksi buku di sekolah belum akomodasi kebutuhan siswa. *ANTARA News*. <https://www.antaranews.com/berita/3460938/kaperpusnas-koleksi-buku-di-sekolah-belum-akomodasi-kebutuhan-siswa>
- Guo, Y., Puranik, C., Kelcey, B., Sun, J., Dinnesen, M. S., & Breit-Smith, A. (2020). The role of home literacy practices in kindergarten children's early writing development: A one-year longitudinal study. *Early Education and Development*, 31(6), 1–23.
- Henson, K. T. (2015). *Curriculum planning: Integrating multiculturalism, constructivism, and education reform* (5th ed.). Waveland Press.
- Huang, Y.-M., Liang, T.-H., Su, Y.-N., & Chen, N.-S. (2022). Empowering personalized learning with digital reading platforms: Effects on engagement and comprehension. *Computers & Education*, 184, 104517.



- Jewitt, C. (2008). Multimodality and literacy in school classrooms. *Review of Research in Education*, 32(1), 241–267.
- Leu, D. J., Forzani, E., Rhoads, C., Maykel, C., Kennedy, C., & Timbrell, N. (2013). The new literacies of online research and comprehension: Rethinking the reading achievement gap. *Reading Research Quarterly*, 46(3), 260–277.
- Mangvwat, S. E., & Meshak, V. J. (2022). Enhancing Literacy Development in Nigeria through Reading and Writing Skills Development. *Journal of Education and Practice*, 6(1), 48–59.
- MetaMetrics Inc. (2020, August). *Lexile® Measures Overview*. MetaMetrics Inc. Retrieved from <https://metametricsinc.com/wp-content/uploads/2020/08/Lexile-Measures-Overview.pdf>
- Moje, E. B., Ciechanowski, K. M., Kramer, K., Ellis, L., Carrillo, R., & Collazo, T. (2004). Working toward third space in content area literacy: An examination of everyday funds of knowledge and Discourse. *Reading Research Quarterly*, 39(1), 38–70. <https://doi.org/10.1598/RRQ.39.1.4>
- Moltudal, S. H., Krumsvik, R. J., & Høydal, K. L. (2022). Adaptive Learning Technology in primary education: Implications for professional teacher knowledge and classroom management. *Frontiers in Education*, 7, 830536. <https://doi.org/10.3389/feduc.2022.830536>
- Nasihah, F., & Tabroni, I. (2022). Fostering Literacy Culture through Reading and Writing Movement. *Jurnal Pengabdian Masyarakat Bestari*, 1(8), 779–792.
- OECD. (2019). *The future of education and skills 2030: OECD education working papers, No. 203*. OECD Publishing.
- Quraishi, T., Ulusi, H., Moihd, A., & Hakimi, M. (2023). Empowering students through digital literacy: A case study of successful integration in a higher education curriculum. *Journal of Digital Learning and Distance Education*, 2(8), 668–681.
- Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review*, 78(1), 40–59. Retrieved from <https://dpi.wi.gov/sites/default/files/imce/cal/pdf/teaching-dl.pdf>
- Smith, M., Turner, J., Sanford-Moore, E., & Koons, H. H. (2016). The Lexile Framework for Reading: An Introduction to What It Is and How to Use It. In Q. Zhang (Ed.), *Pacific Rim Objective Measurement Symposium (PROMS) 2015 Conference Proceedings* (pp. 411–424). Springer.
- Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review*, 22(2), 123–138. <https://doi.org/10.1007/s10648-010-9128-5>
- Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.
- United Nations Educational, S. and C. O. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- Vaughn, S., Martinez, L. R., Wanzek, J., Roberts, G., Swanson, E., & Fall, A. M. (2016). Improving content knowledge and comprehension for English language learners: Findings from a randomized control trial. *Journal of Educational Psychology*, 108(3), 1–17.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. A.-J.-S. Cole V. A2_3 - Scribner S. A2_4 - Souberman E., Ed.). Harvard University Press.
- Wu, J., & Chen, D.-T. v. (2020). A systematic review of educational digital storytelling. *Computers & Education*, 147, 103786.
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64–70. <https://doi.org/10.1207/154304502753458703>