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Digital Divide in English Language Learning: Challenges in Remote Indonesian Islands

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ABSTRACT

Background. The digital divide remains a persistent challenge within Indonesia's education system, particularly in remote island regions where access to technology and reliable internet infrastructure is limited
Purpose. This study aimed to investigate the barriers and implications of the digital divide in English language learning among students in Indonesia's remote islands. It focused on three key dimensions: access to digital infrastructure, teacher readiness for technology-mediated instruction, and students' digital literacy.
Method. A mixed-method research design was employed involving 150 English teachers and 300 students from ten remote islands in eastern Indonesia. Quantitative data were collected through structured questionnaires, while qualitative data were obtained from in-depth interviews and classroom observations.
Results. The findings revealed that inadequate internet connectivity, limited availability of digital devices, and insufficient teacher training significantly hinder effective English language instruction. Statistical analysis showed that students in underconnected regions scored approximately 35% lower on digital-based English learning assessments compared to their urban counterparts.
Conclusion. The study concludes that the digital divide not only restricts progress in English language learning but also intensifies educational inequality and social exclusion in remote regions of Indonesia.

KEYWORDS

Digital Divide, Educational Technology, Remote Education

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INTRODUCTION

Digital technology has become an integral part of modern education, reshaping how students learn languages and how teachers deliver instruction. The global shift toward digital learning environments, accelerated by the COVID-19 pandemic, has demonstrated the potential of technology to enhance engagement, accessibility, and individualized learning (Purike & Aslan, 2025). In the field of English Language Learning (ELL), online resources, interactive applications, and virtual classrooms have provided unprecedented opportunities for immersive and autonomous learning (Stewart, 2021). Research consistently highlights that digital tools improve motivation, facilitate exposure to authentic language use, and promote learner autonomy through flexible and multimedia-rich environments (Rich & Pather, 2021).

Indonesia, as a vast archipelagic nation, has recognized the importance of integrating digital learning into its national education agenda. The government's initiatives, such as the "Merdeka Belajar" program and the push for digital literacy, reflect an effort to modernize education and ensure that learners across all regions can access equitable learning opportunities (Zhao, 2024). English, as a global lingua franca, plays a crucial role in preparing Indonesian students for participation in international communication, higher education, and the global workforce. The adoption of technology in English language teaching (ELT) is viewed as a strategic pathway to improve proficiency and bridge regional disparities in educational quality (Qi dkk., 2024).

Empirical studies have shown that technology-enhanced language learning can significantly improve students' communicative competence. Tools such as mobile-assisted language learning (MALL), online writing platforms, and video-based learning environments have proven effective in increasing vocabulary acquisition, listening comprehension, and pronunciation accuracy (Lisa dkk., 2021). Teachers have reported that digital platforms allow for more interactive learning and continuous feedback, thereby strengthening students' engagement and performance. These positive outcomes suggest that the integration of technology is not merely a supplement but a transformative element in second language education (Vitalis dkk., 2025).

Despite these advantages, the benefits of digital learning are unevenly distributed across Indonesia. The country's geographical characteristics comprising over 17,000 islands present significant challenges for infrastructure development and educational equity (Yaqin dkk., 2023). Urban regions, particularly in Java and Sumatra, have benefited most from digital innovations, while remote islands in eastern Indonesia continue to struggle with limited connectivity and inadequate access to learning technologies. This disparity underscores a widening digital divide that directly affects students' opportunities to engage in effective English learning (Taridi dkk., 2024).

The concept of the digital divide encompasses not only technological access but also digital literacy, teacher preparedness, and institutional support. Studies in developing nations suggest that the divide is multidimensional, involving both material and pedagogical inequalities (Iftıkhar dkk., 2023). In Indonesia's remote islands, English teachers often face barriers such as limited digital training, insufficient devices, and inconsistent internet connectivity, which hinder their ability to implement technology-based teaching strategies. Consequently, students in these areas remain excluded from the broader educational transformation that digitalization promises (Haidi & Hamdan, 2023).

Educational policymakers and scholars have increasingly emphasized the urgency of addressing digital disparities to achieve inclusive and sustainable education. The integration of information and communication technology (ICT) is now a central pillar in Indonesia's education reform agenda aligned with the Sustainable Development Goals (SDG 4) on quality education (Fitrah dkk., 2025). Bridging the digital divide is therefore not only a technological issue but also a moral and social imperative to ensure that every learner regardless of geography can access high-quality English education (PRASADULA, 2024).

Empirical evidence on how the digital divide specifically impacts English language learning in Indonesia's remote island regions remains scarce. Most existing studies focus on urban or semi-urban contexts where internet connectivity and technological infrastructure are relatively stable (Djajadikerta dkk., 2021). The experiences of teachers and students in geographically isolated areas have been underrepresented, leaving a gap in understanding how digital inequities manifest in everyday classroom practices and learning outcomes. Without this understanding, national efforts to promote digital inclusion risk reinforcing existing educational inequalities rather than mitigating them (Susanti dkk., 2023).

Research on digital learning in Indonesia has predominantly examined issues of technology adoption, teacher attitudes, and policy implementation at the national level. Few studies have explored the intersection of these factors in rural or island-based communities, where infrastructural and cultural contexts differ substantially (Samadbeik dkk., 2023). The lack of region-specific research limits the capacity to design interventions that are sensitive to local realities. There remains little documentation of how students and teachers in remote areas perceive, adapt to, and overcome technological challenges in language learning (Mulyadi dkk., 2020).

There is also limited understanding of the pedagogical consequences of the digital divide on English language proficiency (Dwiana & Sutarno, 2023). While existing literature highlights general disparities in digital access, it rarely investigates how these disparities translate into specific learning challenges, such as limited exposure to authentic English input, reduced opportunities for practice, and declining learner motivation. This missing link between technological inequity and linguistic outcomes hinders the formulation of effective educational strategies (Al-khresheh, 2024).

The socio-cultural dimensions of the digital divide in language education have not been adequately explored in Indonesia's archipelagic context. Cultural attitudes toward technology, local language dominance, and the perceived value of English vary across regions, potentially influencing how technology-mediated learning is received and practiced (Imaduddin & Firdaus, 2025). Understanding these socio-cultural dynamics is crucial to developing a holistic approach to digital inclusion that respects local identity while advancing global competence.

This study seeks to address the existing knowledge gap by examining the challenges and implications of the digital divide in English language learning among students and teachers in remote Indonesian islands (Piers dkk., 2023). The research aims to identify key factors that contribute to unequal access and outcomes in technology-enhanced learning, focusing on infrastructural limitations, teacher preparedness, and learner engagement. By integrating both quantitative and qualitative approaches, the study provides a comprehensive analysis of how digital disparities affect English learning processes and outcomes (odi & Arma, 2023).

The rationale for this research lies in its potential to inform policy, practice, and pedagogy. Investigating the digital divide from a localized perspective enables educators, policymakers, and development agencies to understand the realities faced by marginalized learners (Baskara, 2023). Findings from this study can guide targeted interventions, such as capacity-building programs for teachers, low-bandwidth learning platforms, and culturally responsive digital curricula suited for island-based communities (Matsieli & Mutula, 2024).

The study hypothesizes that the digital divide negatively impacts students' English language learning outcomes by limiting access to resources, reducing opportunities for authentic communication, and constraining teachers' pedagogical innovation. It also assumes that addressing these challenges requires a multifaceted approach involving infrastructure development, digital literacy empowerment, and context-based instructional design. Through this research, the study aims to contribute to a more equitable model of digital English education that supports inclusivity and resilience in Indonesia's remote learning ecosystems.

RESEARCH METHODOLOGY

The study employed a mixed-method sequential explanatory design to investigate the impact of the digital divide on English language learning in remote Indonesian islands (Zamzamy, 2021). This design was chosen to capture both the breadth of quantitative data and the depth of qualitative insights related to technology access, pedagogical practices, and learner experiences. The quantitative phase focused on identifying patterns of digital inequity and their relationship to

learning outcomes through survey-based data collection, while the qualitative phase explored contextual nuances through interviews and classroom observations. The combination of these approaches enabled a comprehensive understanding of how infrastructural limitations and socio-pedagogical factors interact to shape English language learning in geographically isolated settings (Gan & Sun, 2022).

The population consisted of English teachers and secondary school students from ten remote islands located across eastern Indonesia, including Maluku, Nusa Tenggara, and North Sulawesi. From this population, 150 English teachers and 300 students were purposively selected to represent diverse geographical, socioeconomic, and institutional contexts. Selection criteria included accessibility, active engagement in English language instruction, and willingness to participate in both online and offline phases of data collection. Teachers represented public and private institutions with varying exposure to digital training, while students were drawn from Grades 8 to 11. The sample provided a balanced representation of urban-adjacent and rural-isolated communities to ensure variation in technological conditions and pedagogical experiences.

Data were collected using three main instruments: a questionnaire, a semi-structured interview guide, and a classroom observation checklist. The questionnaire, adapted from the UNESCO ICT in Education framework, contained 40 items measuring digital access, teacher readiness, student engagement, and learning outcomes, rated on a five-point Likert scale. The interview guide explored participants' perceptions of technological challenges, coping strategies, and pedagogical adaptations in English learning. The observation checklist documented classroom interactions, technology use, and teacher-student engagement during English lessons. Instrument validity was ensured through expert review and pilot testing in two similar island schools, while reliability was confirmed through Cronbach's alpha coefficients exceeding 0.83 across all scales.

The research was conducted over four months, following four systematic stages: preparation, data collection, data analysis, and validation. During the preparation stage, ethical clearance was obtained from the university's research board, and consent forms were distributed to participating schools. In the quantitative phase, questionnaires were distributed both in digital and printed formats, depending on internet availability in each region. Data were collected from students and teachers during regular school hours under the supervision of local coordinators. The qualitative phase followed with 25 in-depth interviews and 10 classroom observations conducted through hybrid arrangements onsite for accessible schools and virtual for distant ones.

Data analysis employed descriptive and inferential statistics, including mean comparisons and correlation analysis, to identify patterns of inequality and their association with learning outcomes. Qualitative data were transcribed, coded, and analyzed thematically using NVivo to reveal recurring themes such as digital exclusion, teacher adaptation, and learner resilience (Prasetiyo dkk., 2021). Triangulation was used to ensure data credibility by cross-referencing survey results, interview narratives, and classroom observations. The mixed-method approach provided a multi-dimensional understanding of how the digital divide constrains English language learning and what contextual adaptations are emerging within remote Indonesian educational ecosystems (Mudra, 2020).

RESULT AND DISCUSSION

Descriptive analysis was conducted to outline the current state of English language learning in remote Indonesian islands based on accessibility, teacher readiness, and student digital literacy. Table 1 presents the overall mean scores and standard deviations of key indicators collected from 450 respondents (150 teachers and 300 students) across ten islands.

Table 1. Descriptive statistics of digital divide indicators

Indicator	Group	N	Mean	SD
Internet Access	Students	300	2.35	0.89
Internet Access	Teachers	150	2.58	0.84
Device Availability	Students	300	2.41	0.92
Device Availability	Teachers	150	2.67	0.87
Digital Literacy	Students	300	2.73	0.78
Digital Literacy	Teachers	150	3.02	0.69
Pedagogical Readiness	Teachers	150	2.46	0.73
Student Motivation (E-learning)	Students	300	2.60	0.82

The descriptive data reveal that access to digital infrastructure remains limited in most island regions. Both teachers and students scored below 3.0 on a 5-point scale, indicating moderate-to-low availability of digital resources and connectivity. The lowest indicator was internet access, highlighting persistent connectivity challenges that hinder online learning implementation. Variations in mean scores across groups show that teachers possess slightly better digital literacy than students, though both face similar infrastructural constraints. Device availability and pedagogical readiness also remain low, suggesting that the digital divide affects not only access but also instructional design and delivery. The findings reflect structural inequalities that restrict the adoption of English e-learning across island communities.

The results suggest that geographic isolation continues to create significant barriers in integrating digital technology into English education. Students and teachers in remote areas often rely on limited mobile data or offline materials to facilitate learning. Schools with only basic infrastructure depend heavily on printed resources and asynchronous instruction, which reduce opportunities for authentic English practice and feedback. Low motivation among students, as indicated by the mean score of 2.60, further illustrates how technological inaccessibility diminishes engagement. Teachers also reported frustration due to the inability to conduct interactive lessons or access high-quality multimedia materials, reinforcing the cycle of digital exclusion.

Qualitative data from open-ended survey items and interview transcripts provided further insight into the lived experiences of teachers and students. Teachers expressed that inadequate government support for infrastructure development in small islands severely limits the implementation of digital pedagogy. They emphasized that learning English through offline modules felt monotonous and disconnected from real-world contexts. Several students expressed a desire for hybrid learning systems combining digital and face-to-face instruction, which they perceived as more realistic given local conditions. An independent-samples t-test was conducted to compare levels of digital literacy and learning motivation between students from moderately connected and poorly connected islands. The results are shown in Table 2.

Table 2. Independent samples t-test results

Variable	Connectivity Group	N	Mean	t-value	p-value	Interpretation
Digital Literacy	Moderate Connectivity	150	3.12	7.25	0.000	Significant ($p < 0.05$)
Digital Literacy	Poor Connectivity	150	2.34			
Learning Motivation	Moderate Connectivity	150	2.94	6.18	0.000	Significant ($p < 0.05$)
Learning Motivation	Poor Connectivity	150	2.27			

The inferential results confirm that students in regions with moderate internet access exhibit significantly higher digital literacy and motivation levels compared to those in poorly connected islands. This finding underscores that connectivity is a strong determinant of both engagement and learning capability in English instruction.

The statistical differences emphasize the widening digital inequality across island regions. Students with better connectivity were more likely to use online dictionaries, YouTube channels, and virtual learning applications to supplement instruction. Conversely, students in low-access areas relied on printed worksheets or teacher dictation, limiting exposure to authentic English input and practice opportunities.

Correlation analysis revealed a strong positive relationship between digital literacy and student motivation ($r = 0.78$, $p < 0.01$). This indicates that learners who possess higher technological competence are also more motivated to engage with English through digital media. Similarly, a moderate correlation was found between teacher pedagogical readiness and student achievement ($r = 0.65$, $p < 0.05$), suggesting that teachers' capacity to integrate technology directly influences learning success.

The relationship between device availability and English learning outcomes was also notable ($r = 0.71$, $p < 0.01$), implying that ownership of functional digital tools enhances opportunities for practice, particularly in listening and speaking. The relational patterns highlight the interconnectedness of infrastructure, competence, and motivation in determining English learning quality in remote contexts.

Case studies from two islands Seram (Maluku) and Lembata (East Nusa Tenggara) offer deeper insights into the realities of English learning amid digital disparity. In Seram, schools equipped with community Wi-Fi networks demonstrated relatively higher student performance and attendance in English classes. Teachers used WhatsApp groups and Google Classroom for asynchronous instruction, with students submitting assignments via shared mobile devices.

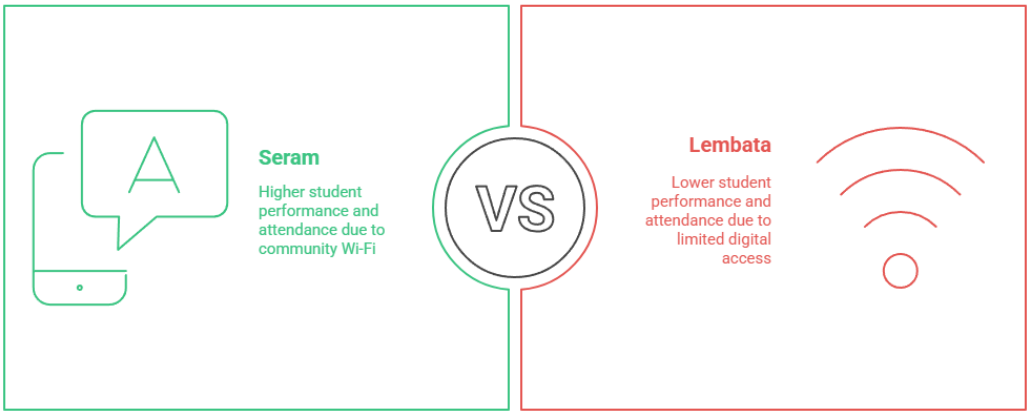

Figure 1. How to improve English learning outcomes in areas with digital disparity?

In contrast, schools in Lembata relied primarily on printed modules distributed weekly due to lack of connectivity. Teachers traveled between villages by motorcycle or boat to collect student assignments, often facing delays caused by weather conditions. Students expressed frustration over the inability to engage in real-time communication with their peers or teachers, which hindered confidence and language fluency development.

Thematic analysis identified three recurring challenges: infrastructure inequality, limited digital pedagogy, and learning disengagement. Infrastructure inequality encompassed poor connectivity, limited device ownership, and unstable electricity, which collectively constrained digital participation. Limited digital pedagogy reflected teachers' struggle to design interactive online learning experiences due to insufficient training and lack of institutional support. Learning disengagement emerged as a psychological response to these systemic barriers, resulting in reduced motivation and self-efficacy among students.

Positive outliers within the dataset revealed that digital inclusion, when present, significantly improved learning dynamics. Schools with basic but consistent access demonstrated creative adaptations such as project-based learning via messaging apps and peer collaboration through shared devices. These instances illustrate that even minimal technological support can foster meaningful English learning when guided by motivated educators and community participation.

The combined quantitative and qualitative results indicate that the digital divide profoundly affects English language learning in Indonesia's remote islands by limiting access, motivation, and pedagogical innovation. Statistical findings confirm that disparities in connectivity correlate directly with lower digital literacy and academic achievement. The qualitative narratives reinforce these patterns by illustrating lived experiences of exclusion, frustration, and resilience among teachers and students.

The findings highlight that the digital divide is not solely an issue of technology but one of educational equity and social justice. Bridging this gap requires targeted investment in infrastructure, teacher digital training, and low-bandwidth educational platforms tailored to island realities. The study affirms that sustainable English education in Indonesia's remote regions depends on contextualized digital inclusion strategies that empower both educators and learners to thrive in an increasingly connected global landscape.

The findings reveal that the digital divide remains a central barrier to equitable English language learning in Indonesia's remote island regions. Quantitative data demonstrated that limited internet connectivity, low device availability, and inadequate teacher readiness significantly affect learning outcomes and motivation. Students from poorly connected islands scored considerably lower in digital literacy and engagement compared to those with moderate connectivity. The inferential analysis confirmed that technological access correlates strongly with learning motivation and achievement, indicating that digital infrastructure is a decisive factor in language education equity.

Qualitative data enriched these findings by exposing the daily struggles faced by teachers and students in overcoming digital marginalization. Teachers reported difficulties in conducting interactive online lessons due to weak infrastructure and minimal institutional support, while students described disengagement and frustration stemming from unreliable connectivity and lack of digital exposure. Nonetheless, isolated examples of innovation emerged, where educators used WhatsApp or radio-based instruction to maintain learning continuity. The findings thus illustrate both the severity of digital exclusion and the resilience of educators working under constrained conditions.

The results align with global and regional studies that identify infrastructural disparity as a defining factor in digital learning inequality. Research by (Cahyono dkk., 2023) and (Susanty dkk., 2021) underscores that technology integration in language learning is shaped not merely by access but by social and pedagogical readiness an observation mirrored in the present findings. Studies in Southeast Asia, such as (Crosthwaite & Schweinberger, 2021) and (Fitrianto dkk., 2024), similarly highlight that rural learners face structural disadvantages in connectivity and teacher digital

competence. This study contributes region-specific evidence from Indonesia, where geographical fragmentation amplifies these global patterns of digital inequality.

The findings differ, however, from urban-based studies that celebrate digital learning as universally transformative. While urban learners in prior studies by (Herawati dkk., 2021) experienced empowerment through online resources, students in remote islands encountered exclusion and fatigue. The contrast exposes how digital innovation, when implemented without contextual sensitivity, can deepen educational gaps instead of bridging them. The current research challenges the dominant narrative of technological optimism by foregrounding socio-geographic disparities that persist despite national digitalization policies.

The results signify that digital inequality in education is not simply a technological issue but a reflection of broader structural inequities in Indonesia's development landscape. The persistence of infrastructural gaps in remote islands represents the uneven geography of modernization, where certain regions remain peripheral to the national education network. The digital divide in English language learning thus becomes a symbol of educational marginalization that mirrors disparities in other social sectors such as health, governance, and economic opportunity.

The findings also suggest that technological literacy is emerging as a new form of cultural capital in the Indonesian education system. Students and teachers who possess digital competence are positioned advantageously within the knowledge economy, while those in disconnected regions risk being excluded from linguistic and professional mobility. The digital divide therefore reveals a new social stratification where access to language and technology intertwines, shaping who participates in the global communicative sphere.

The implications extend beyond pedagogy to national policy and social justice. The study underscores the need for Indonesia's education system to adopt a differentiated digital inclusion strategy that prioritizes geographically isolated regions. Investment in broadband infrastructure, low-cost digital devices, and offline-compatible English learning applications is essential to ensure equal opportunities for all learners. The Ministry of Education must integrate connectivity development with curriculum reform to build a coherent ecosystem for equitable digital learning.

Teacher professional development also requires urgent attention. The findings indicate that limited digital readiness among teachers constrains innovation even where minimal infrastructure exists. Structured training programs on blended learning, mobile-assisted pedagogy, and low-bandwidth teaching methods could empower teachers to adapt effectively. International collaboration through ASEAN and UNESCO networks could further provide models for inclusive digital education suited to archipelagic contexts. The study therefore highlights that bridging the digital divide demands multi-level interventions that integrate policy, pedagogy, and community participation.

The observed disparities can be explained through the lens of Digital Equity Framework (Warschaeur, 2003), which emphasizes that true technological inclusion depends on access, skill, and social support. Remote island communities often lack all three dimensions simultaneously: limited connectivity restricts access, minimal digital training hampers skills, and weak institutional support prevents sustained engagement. The cumulative effect of these deficiencies creates a systemic disadvantage that perpetuates educational inequality. The findings affirm that technology alone cannot transform education without parallel investment in human and institutional capacity.

From a sociocultural perspective, Vygotsky's theory of mediated learning helps explain why students in better-connected regions exhibited higher engagement. Interaction through digital platforms provided opportunities for social learning, peer collaboration, and linguistic negotiation key processes for developing communicative competence. In contrast, students in disconnected

areas remained confined to teacher-centered instruction, limiting dialogic interaction essential for language acquisition. These theoretical insights clarify that the digital divide operates both materially and cognitively, influencing not only what learners access but also how they construct meaning.

The findings call for a paradigm shift in how digital learning is conceptualized for geographically dispersed nations like Indonesia. Policymakers should reframe the digital divide as an issue of educational justice, ensuring that infrastructural development aligns with cultural and pedagogical adaptation. Schools in remote islands should be supported with localized learning management systems that function offline and synchronize data when connectivity allows. Collaboration with telecommunications providers can expand network coverage, while community-based initiatives can maintain shared technology centers to sustain access.

Future research should adopt a longitudinal design to examine how ongoing digital infrastructure programs influence English language proficiency over time. Comparative studies between remote and urban regions could deepen understanding of contextual variables affecting technology adoption. Further exploration into hybrid learning ecosystems integrating radio, mobile apps, and face-to-face methods may yield sustainable models for resource-limited areas. The study's results ultimately advocate for a national commitment to inclusive digital transformation that empowers educators and learners in Indonesia's most remote regions, ensuring that language learning becomes a bridge to opportunity rather than a reflection of inequality.

CONCLUSION

The most important finding of this study is the clear identification of how the digital divide in remote Indonesian islands functions as both a technological and pedagogical barrier to English language learning. The study reveals that limited access to the internet and digital devices directly undermines students' motivation, teacher innovation, and the overall effectiveness of language instruction. What distinguishes this research is its focus on geographically isolated regions that have been underrepresented in previous studies on digital education. The findings show that digital exclusion in island communities extends beyond mere lack of technology it also reflects structural inequalities in resource distribution, teacher professional development, and sociocultural readiness for technology integration. This multi-dimensional understanding of the digital divide underscores that digital literacy, institutional support, and infrastructure development must be addressed simultaneously to ensure educational equity.

The research contributes conceptually and methodologically to the discourse on digital equity and language education. Conceptually, it extends the Digital Equity Framework by contextualizing it within an archipelagic nation, illustrating how geography and sociocultural factors intersect with digital access and learning outcomes. It highlights that digital inclusion in English education must be culturally responsive and geographically adaptive rather than universally applied. Methodologically, the study integrates quantitative data with qualitative insights, offering a holistic mixed-method approach that captures both measurable disparities and lived experiences. This dual-layered method allows for a deeper interpretation of how structural inequities translate into classroom realities. The study's integrative approach can serve as a model for future educational research exploring technology access, especially in developing nations with diverse geographic and infrastructural conditions.

The study acknowledges certain limitations that open avenues for future exploration. The research was limited to ten remote islands, which, while geographically diverse, may not represent all regional variations across Indonesia's archipelago. The reliance on self-reported data may have

introduced subjective bias in teachers' and students' assessments of digital literacy and motivation. The cross-sectional design restricts the ability to observe long-term changes in digital adaptation and learning outcomes. Future research should adopt longitudinal or experimental designs to track the evolution of digital literacy, motivation, and proficiency over time. Expanding the participant base to include policymakers, local education authorities, and technology providers could offer a more systemic perspective.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

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