RESEARCH ARTICLE
published: 15 April 2026
doi: 10.21070/pedagogia.v15i2.2208

Technology Challenges and Opportunities in Indonesian School Education

Tantangan dan Peluang Teknologi dalam Pendidikan Sekolah Indonesia

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General Background: Technology has become an essential component in contemporary education, supporting teaching and learning practices across diverse contexts. **Specific Background:** This study explores technology use in schools across three Indonesian islands Sumatra, Kalimantan, and Sulawesi through a holistic review of 34 newspaper and online articles published between 2022 and 2024. **Knowledge Gap:** Previous studies have rarely utilized newspaper sources to examine region-specific technological issues in Indonesian education, particularly across multiple islands. **Aims:** The study aims to identify key issues and challenges associated with integrating technology into teaching and learning practices in these regions. **Results:** The findings reveal that limited infrastructure, including inadequate computers and slow internet access, remains a major challenge, especially in Kalimantan and Sulawesi, while more structured technological initiatives are evident in Sumatra; despite constraints, schools demonstrate adaptive strategies such as digital literacy programs, coding activities, and the use of simple technologies to support learning engagement. **Novelty:** The study introduces a holistic literature review approach based on newspaper data to map educational technology conditions across geographically diverse regions. **Implications:** The results highlight the need for collaborative support among schools, government, and private sectors, as well as the importance of preparing pre-service teachers to utilize low-bandwidth and simple technologies suitable for remote educational settings.

Highlights

- Limited infrastructure remains a central barrier in multiple regions
- Rural classrooms adopt adaptive digital practices despite constraints
- Teacher education requires focus on simple technology utilization

Keywords: Educational Technology; Rural Education; Digital Infrastructure; Teacher Education; Indonesia

OPEN ACCESS

ISSN 2548 2254 (online)
ISSN 2089 3833 (print)

Edited by:
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Reviewed by:
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Received: 27 February 2026
Accepted: 02 March 2026
Published: 15 April 2026

Citation:
Yustinus Calvin Gai Mali, Ike Tresiani, Novie Feronika Harwanto, Reza Renita, Arlinda Putriani, Anita Widiprastyanti, Meykke Alvia Yuntiawati, Elmi Erinta, Rizky Setiawan Samsuar, Raynaldo Gusti Arya, Narendra Setiawan Herawarman

(2026)
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Pedagogia: Jurnal Pendidikan. 15:2.doi: 10.21070/pedagogia.v15i2.2208

INTRODUCTION

In recent years, technology, including electronic tools, hardware, and software, has become increasingly intertwined with the Internet (Kritandani et al., 2024; Mali, 2024; Mali & Santosa, 2021), playing a significant role in education by supporting effective teaching and learning practices. With the recent development of artificial intelligence tools that can simulate human thinking and action (Mali, 2025a; Sumakul et al., 2022), technology now has even more capabilities to make teaching and learning practices more engaging and enjoyable for students. That development now makes technology in a school no longer an option, but a primary component of today's school (Richards, 2015). In this era of technological development, the authors are interested in exploring potential issues and challenges associated with using technology to support teaching and learning practices that may persist across various educational institutions, specifically those located on three different islands in Indonesia: Sumatra, Kalimantan, and Sulawesi. The exploration results should provide clear evidence of the technological conditions, issues, or challenges in educational institutions in those islands, which might benefit practitioners and pre-service teachers planning to teach in schools with similar characteristics.

The present study should expand on what the previous studies (e.g., Cahyani & Cahyono, 2012; Hafifah & Sulistyo, 2020; Mali, 2025b; Son et al., 2011) had explored by analyzing local and national newspapers, as well as online articles, reporting on the technology issues and challenges associated with utilizing technology in the three islands, areas that previous studies had not covered. With all the backgrounds in mind, the authors would like to answer the following research question: *What are the issues and challenges associated with utilizing technology to support teaching and learning practices in various educational institutions located on three different islands in Indonesia: Sumatra, Kalimantan, and Sulawesi?* The following section presents the method of the current study.

METHODS

To answer the research question, the authors adapted a holistic literature review method, as described by Li (2012) and Mali et al. (2023). The method was employed to review newspaper articles and online articles relevant to the study's objectives. More specifically, the authors reviewed newspaper articles published in the last 3 years (i.e., 2022-2024) to ensure the issues covered are current.

In looking for articles, the authors searched online for open-access local and national newspaper articles using *Google Search.* Then, the authors typed the following keywords:

- *masalah teknologi di sekolah di Sumatra* (Technological issues in schools in Sumatra)
- *penggunaan teknologi di sekolah-sekolah di Sumatra* (Use of technology in schools in Sumatra)
- *penerapan teknologi di sekolah Sumatra* (Technology application in schools in Sumatra)
- *pengembangan digital teknologi di Sumatra* (Development of digital technology in Sumatra)
- *realita penggunaan teknologi dalam pendidikan di Sumatra* (Realities of technology use reality of technology use in education in Sumatra)

In the keywords above, the authors replaced the word *"Sumatra"* with *"Kalimantan"* and then *"Sulawesi"* to identify articles discussing issues on those two islands. The authors excluded articles that were not relevant to the research goal and those published before 2022. In total, the authors selected 34 newspaper articles that were primarily relevant to the study. The newspaper articles were chosen because they could provide a more detailed account of local issues related to the use of technology in schools located in various regions of Sumatra, Kalimantan, and Sulawesi. Methodologically speaking, analyzing newspaper articles should be a novel approach in literature review studies, which commonly use journal articles as primary data (e.g., see Mali, 2025b; Putri et al., 2023; Teng, 2024; Utami & Santosa, 2023; Zain, 2022).

The authors then worked in three different groups to review the selected articles. Group 1 (or authors 2-5) reviewed articles related to Sulawesi Island, Group 2 (or authors 6-8) focused on Kalimantan Island, and Group 3 (authors 9-11) focused on Sumatra Island. For transparency, the authors provided data extraction tables detailing how each reviewed newspaper article contributed to the research findings. These strategies align with recognized approaches for establishing trustworthiness in a literature review study (Mali, 2025a; Tikhonova & Raitskaya, 2024). Due to the page limitation of the journal, the authors put the data extraction tables in the following GDrive: https://drive.google.com/file/d/1e_0VRDmvRRzNNw4bxmEGWbiALwZueQqr/view?usp=sharing (with the view-only mode).

Each group then analyzed the data presented in the table, focusing on their assigned region. The analysis focused on identifying commonalities among the issues and challenges associated with the use of technology in the islands. The commonalities were then developed into themes, which the authors presented in the findings section.

The authors then conducted peer debriefing activities similar to those successfully employed by previous researchers (e.g., Kritandani et al., 2024; Mali et al., 2023; Mali & Salsbury, 2021). Peer debriefing activities could help ensure the credibility of the review results presented in this paper. Practically speaking, after each group finished analyzing the articles, they presented their analyses on PowerPoint slides during an online meeting on February 20th, 2025. This meeting was organized and moderated by the first author. Each group had 30 minutes to present their analysis results, followed by a question-and-feedback session with the other groups and the first author. In the feedback session, the authors applied the communication strategies proposed by Mali and Salsbury (2022), which involve neither students positioning themselves as more knowledgeable than the other nor refraining from giving destructive feedback or negatively criticizing the presentation. Each group then used the feedback they obtained to make necessary revisions to the review results presented in this paper.

[Table 1 about here]

FINDINGS AND DISCUSSION

The authors will present the results of their analysis under three different sections: Sumatra, Kalimantan, and Sulawesi. The analysis results in each section should provide detailed descriptions of the issues and challenges encountered in using technology to support teaching and learning in schools. The authors will then discuss the review results in light of the relevant literature.

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Sumatra

Digitalization has been progressively introduced at all educational levels in Sumatra to improve access and learning opportunities. In primary schools, digital tools, including tablets and interactive whiteboards, are being introduced to encourage early technological involvement (Miftahudin, 2025). Students in secondary and junior high schools are utilizing digital resources and online platforms to support their studies and enhance their digital literacy skills. Students in vocational schools utilize electronics training kits as a learning tool to improve their competence in operating digital electronics equipment (Antoni, 2023). Even Madrasahs are incorporating digital technologies to modernize their curriculum and enhance students' understanding (Aang Sabarudin, 2024). This strategy has the potential to ensure that students across all schools in Sumatra are ready for future technological advancements.

The government has collaborated with third parties in supporting the development of technology-supported education in schools across Sumatra. Some of the collaborations include those with Google, Casio, Singapore PTE LTD, and Telkom to promote digital transformation, particularly in schools. For example, Google supported access to digital learning resources and teacher training at government-selected model schools (Makruf, 2024; Sinuhaji, 2024). Casio offers innovative solutions, including technology-based learning tools (Laila, 2025). Telkom also donated digital devices to select schools and established the Pijar Sekolah service as a digital learning platform, encompassing the learning process, learning content, and school management system (Anam, 2022). This collaboration and cooperation aim to enhance the digital learning transformation, leading to improved education quality.

The government has established model schools in Sumatra. Practically speaking, it provides Smartboards and Information Technologies laboratories to support the region's educational digitalization (Anam, 2022; Imam, 2024). The model school is expected to serve as an example of how technology is applied to help students and teachers become more engaged in the teaching and learning process (Makruf, 2024). The government and private institutions, such as Telkom, also conduct socialization programs to train teachers and students on how to use these tools effectively (Anam, 2022), which aims to ensure that students and teachers learn to effectively utilize technology in the teaching and learning process, preparing them for a future driven by technology.

Kalimantan

Limited access to essential digital educational resources hinders educational opportunities in rural areas. A common theme across the articles is the issue of restricted access to crucial digital educational resources, whether it is technology, material, or internet access, especially in remote areas. The economic burden placed on families in East Kalimantan due to the high cost of textbooks suggests the use of e-books as a cost-effective alternative (Ana, 2024; Purnama, 2023). In addition, some schools in remote regions along the border of North Kalimantan face challenges due to slow internet access. That condition makes online learning and research challenging for students (Purnama, 2023). Another article (e.g., Yulianus, 2024) reported the limited access to digital technology in remote areas. These articles signal the strong need to improve infrastructure and digital literacy to address the educational gap in these areas.

The improvement of digital education is crucial for the advancement of rural communities. Another recurring theme in the articles is the progress of digital education across schools in Kalimantan. One article describes how, after a flood, a school was unable to repair its building and facilities, prompting Google Indonesia to donate Chromebooks for school activities (Damayanti & Kasih, 2024). Another article highlights a teacher who took the initiative to teach digital literacy in a remote area. Initially, computer facilitation in the school was not utilized effectively. Then, Suwito teaches the students how to use the computers. The students become much more excited about learning digital technology (Hutapea, 2024).

There are other success stories. An article examines how technology upgrades at a high school have met students' growing need for digital tools during their lessons (Oxtora & Lucinda, 2023). Yet another article discusses an elementary school teacher who successfully initiated educational improvements despite limited resources in the surrounding community (Salsabilah & Agmal, 2024). Collectively, these studies highlight the evolution of digital education and show how some regions are narrowing the educational gap.

Innovation in digital learning fuels student engagement in rural education. The shared theme across the articles is that the Eastern Kalimantan Province Government is upgrading rural areas of Kalimantan by improving technology use in educational institutions. One article reported that a civil servant was deployed to a rural school in Muara Kaman and introduced a learning method to the students (Rezkisari, 2024). This teaching approach relies heavily on digital technology, as teachers progressively introduce computers and the internet to students. This gradual exposure sparks student curiosity, effectively combating boredom and fostering a strong desire to

learn. Technology transforms students' attitudes toward learning when a teacher provides new technology, often a computer (Winarto, 2024). From now on, technology will be used to enhance creativity for both learners and teachers (Arumanto & Hadi, 2024).

Sulawesi

Teacher training emphasizes their proficiency in technology across various regions of Sulawesi. Articles published in Makassar and elsewhere in Sulawesi indicate that teachers require training not only to apply technology but also to optimize the learning experience (Thahir, 2024). Without that training, teachers would struggle to integrate technology purposefully and meaningfully into their classrooms. This all goes to show, therefore, the need for educators to acquire the necessary competencies in digital technology as one step in the modernization of education in Sulawesi (Barru, 2024; Dali, 2024).

Challenges related to equal access to digital learning resources affect students in underprivileged areas. For example, many schools struggle with stable internet connections, which make it hard to access digital learning sources. However, these limitations do not only occur in Tolitoli, but also occur in Central Sulawesi where pupils have difficulties in having online learning as they do not have internet access (Redaksi, 2024) and also in Southeast Sulawesi, where an AI Development Center was established, but it has some challenges such as the needs of high-performance computer equipment (Lestari, 2025).

Schools actively promote digital literacy among students through engaging and interactive lessons. In South Sulawesi, measures are taken to ensure that students develop strong digital literacy skills (Esvandi, 2023; Sumardi, 2024). For example, thousands of students in Sinjai are encouraged to harness digital tools for learning (Dahuri, 2023); meanwhile, in Biau, a middle school was chosen to be equipped with Chromebooks and Google Workspace for Education (Salam, 2024) and several high schools in South Sulawesi were appointed to implement "Smart School" program, which uses "Hybrid" learning, that is a course delivery approach where some students attend class in-person, while others join the class virtually. Educators teach both remote and in-person students and, at the same time, use tools such as video conferencing hardware and software (Nugraha, 2022). In Kendari, Southeast Sulawesi, Alhazen School has introduced coding to its students (Syam, 2023), which is a significant step in early digital education. Such measures point to an increasing acknowledgment of the necessity of students receiving digital literacy to navigate the contemporary world: preparing them not only to be consumers of technology but also to be creators of technology devices/tools.

DISCUSSION

While the findings convey various insights, the authors would like to discuss commonalities regarding the issues and challenges of using technology to support teaching and learning practices across educational institutions on three different islands in Indonesia: Sumatra, Kalimantan, and Sulawesi. First, the main challenges faced by schools are limited technology facilities (e.g., computers and slow Internet access), particularly in Kalimantan and Sulawesi. From time to time, the lack of technological facilities appears to be an unresolved issue in Indonesia (Febriana et al., 2018; Hafifah & Sulistyo, 2020; Mali, 2017). That said, the authors urge the Indonesian government to give serious attention to developing technology facilities in schools across Indonesia, making it a national priority as important as the *Makan Bergizi Gratis* (MBG) or Free Nutritious Meals program. Nevertheless, despite limited technological resources, the articles reported various creative efforts and resilience by local educators and communities to narrow technological gaps and promote students' digital literacy. Second, incorporating technology into learning environments, especially in rural classrooms, provides students with more engaging learning opportunities. That finding should confirm the views of Mali (2024) and Egbert and Shahrokni (2018) that using digital resources enables teachers to create engaging content that enhances their collaboration and digital literacy skills.

The authors concur with the views of the previous researchers (i.e., Fira et al., 2024; Hafifah & Sulistyo, 2020; Owen et al., 2020) that improving the technological facilities and teachers' technology literacy requires serious commitments, collaborative work, and support among schools, the government, and the private sectors. In line with this, the authors see opportunities for schools to request support from universities to send their pre-service teachers to participate in a teaching practice program at the schools, to introduce digital literacy skills to students, and, possibly, to school teachers.

Given the limited technology facilities and internet access in some schools, such as those in Kalimantan and Sulawesi, teachers may need to learn more about using simple technology to support their teaching practices. The simple technology means that teachers do not require sophisticated technical skills to operate it (Mali, 2022). Introducing simple technology tools that might work in remote areas and not require high internet bandwidth should be part of the curriculum in teacher education programs in Indonesia.

Importantly, the exploration of technology can be conducted at the school level, where the headmaster initiates a teacher technology meeting held regularly, once or twice a month. Practically speaking, the headmaster can assign one or two technology-literate school teachers to lead a workshop for school teachers. In the workshop, speakers can be assigned to introduce one or two simple technologies and try them with the other teachers attending. That said, teachers can work in groups based on their teaching subjects to try out the technology and explore ways to utilize and maximize its potential in their teaching contexts, e.g., in English language classrooms. Then, in the following meeting, the teachers can take turns and arrange who will be the speakers. Through the regular meeting, the authors are optimistic that the teachers can be equipped with all the necessary skills and confidence to introduce and teach their students about digital literacy.

Nevertheless, if technology is still not widely accessible

across Indonesia, teachers must be ready to adapt by using offline materials available at their schools (e.g., printed worksheets, books, or downloaded videos). They should also be ready to teach creatively and to consider any learning activities that might not require technology or an internet connection. However, the activities can still provide their students with language-learning opportunities and help them achieve the language-learning objectives set in their classrooms. At this point, the authors concurred with Mali et al.'s (2023) argument that teachers' training programs in universities should also include courses that prepare their students to be pedagogically and mentally ready to teach in schools with limited technology facilities, as presented in this study.

CONCLUSIONS

The authors have reviewed 34 online newspaper articles to examine the issues and challenges of using technology to support teaching and learning in educational institutions across three Indonesian islands: Sumatra, Kalimantan, and Sulawesi. The main challenges faced by schools are related to limited technology facilities. Nevertheless, the government has initiated various efforts to improve technological facilities and infrastructure in schools, though these improvements were mainly found in schools located on Sumatra Island. Nevertheless, despite limited technological facilities, various efforts were made to promote digital literacy among students, including coding lessons (e.g., in Sulawesi), vocational electronics training (e.g., in Sumatra), and hands-on computer use (e.g., in Kalimantan). These efforts require full support from the Indonesian government, which should prioritize the development of existing schools in remote, underdeveloped areas of Indonesia.

There are still some questions the authors cannot answer in this study, but which might be fruitful for future research. How can education faculties at universities in Indonesia prepare pre-service teachers to be ready to teach in schools with limited technology facilities? What kinds of simple technologies can teachers use to support their teaching in schools with similar characteristics as those discussed in this study? What might be the effective ways to enhance students' digital literacy in schools located in remote areas?

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

LIST OF TABLE

Table 1/ The distribution of the newspaper articles reviewed in this paper

No	Islands	Contexts	Authors	Newspaper/ Online Sources
1	Sumatra	Tarutung	Anam (2022)	CNBC Indonesia
2		Langkat	Fauzi (2024)	Antara Sumut
3		West Sumatra	Ismail (2025)	Timenews
4		Solok	Laila (2024)	Antara Sumbar
5		Pariaman	Makruf (2024)	Antara Sumbar
6		Bukittinggi	Miftahudin (2025)	Metronews
7		South Sumatra	Purnama (2024)	Antara Sumsel
8		West Sumatra	Rilis (2023)	Antara Sumbar
9		Palembang	Sabarudin (2024)	Antara Sumsel
10		North Sumatra	Sinuhaji (2025)	Mistar.ID
11	Kalimantan	Samarinda	Ana (2024)	Jurnal Borneo
12		South Kalimantan	Arief (2024)	Media center portal berita Kalimantan Selatan
13		East Kalimantan	Arumanto (2024)	Antaranews.com
14		South Kalimantan	Damayanti and Kasih (2024)	Kompas.com
15		Muara Kaman	Hutapea (2024)	Kompas.com
16		Pontianak	Oxtora and Lucinda (2023)	Kalbar Antaranews
17		Nunukan	Purnama (2023)	Tempo.co
18		East Kalimantan	Rezkisari (2024)	Republika.co.id
19		Samarinda	Rifandi (2025)	Antara Kaltim
20		Kutai Kertanegara	Salsabilah and Agmal (2024)	Kompasiana
21		East Kalimantan	Winarto (2024)	Lifestyle. Kontan
22		Banjarmasin	Yulianus (2024)	Kompas.id
23	Sulawesi	Barru	Barru (2024)	Fajar Sulsel
24		Sinjai	Dahuri (2023)	Media Indonesia
25		South Sulawaesi	Dali (2024)	Suara Guru Sulsel
26		Makassar	Esvandi (2023)	Tribunnews
27		Southeast Sulawesi	Lestari (2025)	Tribun News Sulawesi Tenggara
28		South Sulawesi	Nugraha (2022)	Detik News
29		Central Sulawesi	Redaksi (2024)	Channel Sulawesi
30		Central Sulawesi	Salam (2024a)	Antara News, Palu
31		Central Sulawesi	Salam (2024b)	Antara News, Palu
32		Makassar	Sumardi (2024)	Tribun-Timur

No	Islands	Contexts	Authors	Newspaper/ Online Sources
33		Makassar	Syam (2023)	DetikSultra
34		South Sulawesi	Thahir (2024)	Kabarika