

Transforming Education in Coastal Indonesia: A Survey of Digital Literacy and Competence Among Educators

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Abstract

This research explores the digital literacy and competence of educators in coastal areas of Indonesia, focusing on technology access, usage patterns, and challenges in integrating digital tools into teaching practices. Utilizing a quantitative survey method, data was collected from 235 educators teaching in coastal area schools. The study found a generally positive trend in technology access, with reliable availability of computers, laptops, and internet connection supporting educators' professional tasks. However, gaps in access to up-to-date software highlight the need for improved resources and support to ensure equitable technology use. Educators demonstrated a strong trend towards integrating digital tools in lesson planning and communication with students. Despite this, the uneven adoption of these tools suggests a need for broader and more equitable technology integration. Significant challenges include difficulties in keeping up with technological advancements and managing technical issues, emphasizing the need for comprehensive professional development and targeted training on advanced digital tools and troubleshooting. While the study provides valuable insights, it is limited by its small sample size and geographic focus, potentially not fully representing the diverse experiences of educators across Indonesia. Future research should expand the sample size and geographic range to offer a more comprehensive understanding of technology integration challenges and to support more effective recommendations for enhancing technology use in education.

Keywords: Competence, Coastal Indonesia, Digital Literacy, Educators, Technology Integration.

INTRODUCTION

The rapid advancement of technology has fundamentally transformed various sectors, including education. The integration of digital literacy and competence has become crucial in modern educational systems worldwide (Falloon, 2020; Pangrazio et al., 2020; Tejedor et al., 2020). For educators, effectively utilizing digital tools and resources is essential for enhancing teaching methods, engaging students, and fostering a progressive learning environment. Digital literacy goes beyond merely operating digital devices; it encompasses critical evaluation of information, content creation, and effective communication in a digital context (Buchholz et al., 2020; Pangrazio et al., 2020). This comprehensive skill set is increasingly recognized as essential for both teachers and students in the 21st century.

Digital competence for educators involves multiple dimensions, including technological knowledge, pedagogical skills, and the ability to seamlessly integrate these into their teaching practices. Educators who excel in digital literacy can offer more interactive and engaging learning experiences, tailor instruction to diverse student needs, and prepare students for a future where digital skills are indispensable (Anthonysamy et al., 2020; Istifci & Goksel, 2022; Kim How et al., 2022). The shift towards online and blended learning environments, accelerated by the COVID-19 pandemic, has further underscored the need for teachers to be proficient with digital tools. This transition has highlighted disparities in digital access and proficiency across different regions,

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emphasizing the necessity for targeted efforts to support educators in developing these crucial skills. This issue is particularly pertinent in regions facing unique geographical and socio-economic challenges, such as coastal areas. Coastal regions often grapple with geographical isolation, economic reliance on maritime activities, and vulnerability to environmental factors like climate change (Baldacchino, 2020; Johnson et al., 2020). These challenges can significantly impact educational accessibility and quality, making digital literacy even more vital. Digital tools can serve as a bridge to overcome physical distances, offering access to a wider range of educational resources and opportunities.

In Indonesia, coastal regions face specific educational challenges due to their distinct cultural and economic landscapes. Limited access to technological infrastructure in these areas can impede the development of digital literacy among educators. Factors such as inadequate internet connectivity, a shortage of digital devices, and insufficient professional development opportunities contribute to this gap. Consequently, educators in these regions may struggle to integrate digital tools into their teaching practices effectively, hindering their ability to deliver a modern education. Despite these challenges, there is growing recognition of the need to equip teachers in coastal regions with essential digital skills to bridge the educational divide and promote equitable learning opportunities (Annan, 2020; Ferreira, 2021; Ting et al., 2021). Government initiatives, non-governmental organizations, and private sector partnerships are increasingly focused on enhancing digital infrastructure and providing targeted training for educators. These efforts aim to empower teachers with the skills and confidence needed to utilize digital tools, thus improving the overall quality of education in coastal areas. By addressing the unique challenges faced by educators in these regions, such initiatives can help reduce educational disparities and foster a more inclusive educational system across Indonesia.

This recognition aligns with global trends where digital literacy is considered a necessity for social and economic development. Ensuring that educators in coastal regions are proficient in digital literacy is critical for preparing students to thrive in an increasingly digital world (Bejaković & Mrnjavac, 2020; Liu et al., 2020; Morgan et al., 2022). Thus, a concerted effort to enhance digital literacy and competence among educators in these areas is essential for fostering educational equity and promoting long-term sustainable development. Despite the acknowledged importance of digital literacy, there is a lack of research focusing on the specific needs and capabilities of educators in Indonesia's coastal regions. Most existing studies emphasize urban settings, where technological infrastructure is relatively more accessible (Basso et al., 2020; Porru et al., 2020; Wang et al., 2021). This urban-centric focus leaves a significant knowledge gap regarding the digital readiness of teachers in remote and underserved areas, such as coastal regions. The unique challenges faced by educators in these areas necessitate a thorough understanding of their specific needs and capabilities concerning digital literacy and competence.

The geographical isolation of many coastal areas exacerbates these challenges. Limited access to stable internet connections, scarcity of digital devices, and a lack of tailored professional development opportunities hinder educators' exposure to digital tools and technologies. These disparities in digital access and proficiency between urban and coastal regions underscore the importance of addressing the specific context and needs of coastal educators. Understanding how educators perceive and engage with digital tools, and their preparedness to integrate these tools into their teaching practices, is crucial. Teachers' attitudes towards digital tools significantly influence their willingness and ability to incorporate these technologies into their classrooms (Lim & Newby, 2021; Raygan & Moradkhani, 2022; Wohlfart et al., 2021). Factors such as confidence in using digital tools, perceived relevance of digital literacy, and availability of support resources play critical roles in shaping these perceptions.

A survey research approach can provide valuable insights into these dynamics by capturing the experiences, attitudes, and needs of educators in coastal regions. This methodology allows for the collection of quantitative data on various aspects of digital literacy and competence, including technology access, usage patterns, perceived challenges, and professional development needs (Braun et al., 2021; Liang, 2024). By analyzing survey data, researchers can identify common trends, gaps, and areas for improvement. This data can inform the development of targeted interventions, such as customized training programs, enhanced access to digital resources, and policy initiatives aimed at supporting educators. Exploring the digital literacy and competence

of educators in coastal regions through survey research can also provide insights into broader issues of educational equity and inclusion. Highlighting specific challenges and opportunities in these areas can inform policies and practices that promote more equitable access to quality education across different regions. This, in turn, can help narrow the educational divide and foster a more inclusive and resilient education system in Indonesia (Arnhold & Bassett, 2021; Green et al., 2020).

As such, addressing the knowledge gap regarding digital readiness among educators in Indonesia's coastal regions is essential for promoting equitable educational opportunities. This study aims to explore the digital literacy and competence of educators in these areas through a quantitative survey research approach. By systematically investigating educators' experiences, perceptions, and challenges, the study will provide valuable insights for designing effective interventions and policies. Specifically, the research will address the following questions: How do technology access and usage patterns among educators influence their ability to integrate digital tools into their teaching practices? What are the primary challenges educators face in integrating technology into their curriculum, and how do these challenges affect their professional development needs? Ultimately, this research will contribute to enhancing educational outcomes in coastal regions and support the broader goal of achieving digital inclusion and educational equity in Indonesia.

RESEARCH METHOD

Research Design

This research belongs to the survey research genre, a type of observational study often used in social sciences to gather data from a specific population (Braun et al., 2021). The methodological design involved the collection of quantitative data from a selected sample of teachers across Indonesia. Through the use of a carefully designed Likert-scale questionnaire educators' experiences, perceptions, and challenges, the study will provide valuable insights for designing effective interventions and policies.

Research Participants

The study included 235 educators from Sulawesi (70), Java (45), Kalimantan (65), and Maluku (55). Sulawesi and Kalimantan have a higher number of elementary teachers, while Java and Maluku feature more secondary teachers. Maluku's participants are the oldest, aged 35-55 years, while Java's participants have the broadest age range of 30-50 years. Female educators are more common in Sulawesi and Kalimantan, with Java having fewer males. Most participants hold Bachelor's degrees, with Sulawesi and Kalimantan having the highest numbers, while Master's degrees are more evenly distributed. Most educators have 6-10 years of experience, and Java has fewer participants with over 11 years. This diverse demographic highlights regional differences in occupation, age, gender, and education across Indonesia. All participants provided informed consent and were fully briefed on the research's purpose, their involvement, and their rights. This approach aimed to offer a comprehensive view of digital readiness among educators in Indonesia's coastal regions, crucial for advancing equitable educational opportunities. The demographic information of the participants is presented in Table 1.

Table 1. Demography of participants

Location	Occupation	Age Range	Gender	Educational Background	Teaching Experience	Number of Participants
Sulawesi	Elementary Teacher: 40, Secondary Teacher: 30	25-45	Male: 30, Female: 40	Bachelor's: 50, Master's: 20	1-5 years: 20, 6-10 years: 30, 11+ years: 20	70
Java	Elementary Teacher: 25, Secondary Teacher: 20	30-50	Male: 15, Female: 30	Bachelor's: 30, Master's: 15	1-5 years: 15, 6-10 years: 20, 11+ years: 10	45
Kalimantan	Elementary Teacher: 35, Secondary Teacher: 30	28-48	Male: 20, Female: 45	Bachelor's: 40, Master's: 25	1-5 years: 25, 6-10 years: 25, 11+ years: 15	65
Maluku	Elementary Teacher: 30, Secondary Teacher: 25	35-55	Male: 25, Female: 30	Bachelor's: 35, Master's: 20	1-5 years: 20, 6-10 years: 25, 11+ years: 10	55

		Total				235
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Research Instrument

This research aimed to investigate digital literacy and competence among educators in coastal regions of Indonesia. To achieve this, a 20-item questionnaire was meticulously designed to capture detailed insights into the experiences, attitudes, and needs of these educators. The development of the questionnaire was guided by a comprehensive review of relevant literature, including studies by Bejaković and Mrnjavac, (2020), Liu et al. (2020) and Morgan et al. (2022), ensuring that the instrument was both robust and relevant. The questionnaire underwent rigorous validation processes to confirm its reliability and validity. Data were collected using Google Forms, which were distributed to a diverse selection of secondary schools across Indonesia's coastal areas.

Data Analysis

The collected data were carefully processed and analyzed using a range of descriptive statistical techniques to extract meaningful insights. We calculated frequencies and percentages to effectively summarize participants' views on the various aspects addressed in the questionnaire. These statistics were crucial for understanding how responses were distributed across different items, providing a quantitative representation of teachers' digital literacy and competence in coastal regions of Indonesia. Frequencies were used to determine how often specific responses occurred, helping identify common viewpoints among participants. Percentages offered a relative perspective, highlighting the proportion of different opinions within the dataset. Together, these measures enabled a comprehensive analysis of educators' perceptions and the prevalence of digital literacy and competence in the study's target regions.

FINDINGS

Our research findings are divided into two sections, corresponding to the research questions we previously established. The first section addresses how technology access and usage patterns among educators influence their ability to integrate digital tools into their teaching practices. The second section examines the primary challenges educators face in integrating technology into their curriculum, and how these challenges impact their professional development needs. Our findings are detailed as follows:

RQ. 1: How do technology access and usage patterns among educators influence their ability to integrate digital tools into their teaching practices?

Table 2. Technology Access

No	Statements	SA (%)	A (%)	N (%)	DA (%)	SDA (%)	Total
1	I have reliable access to a computer or laptop for my professional tasks.	40 (17%)	90 (38%)	60 (26%)	30 (13%)	15 (6%)	235
2	I have consistent access to high-speed internet.	50 (21%)	85 (36%)	55 (23%)	30 (13%)	15 (6%)	235
3	I have access to up-to-date software and applications needed for my work.	45 (19%)	80 (34%)	60 (26%)	35 (15%)	15 (6%)	235
4	I can easily access online resources and tools for teaching and learning.	50 (21%)	80 (34%)	55 (23%)	35 (15%)	15 (6%)	235

The data in Table 2 shows the distribution of responses regarding technology access among educators. The majority of respondents reported having reliable access to a computer or laptop for professional tasks, with 55% indicating agreement (40% agree and 15% strongly agree). Access to high-speed internet was similarly well-reported, with a combined 57% affirming consistent availability (21% strongly agree and 36% agree). Regarding access to up-to-date software and applications, 53% of respondents agreed (19% strongly agree and 34% agree). Lastly, 55% of respondents felt they could easily access online resources and tools for teaching and learning (21% strongly agree and 34% agree). These results suggest that while the majority of educators have adequate technology access, there are still notable proportions who experience challenges, particularly in terms of consistent access and updated resources.

Table 3. Usage Patterns

No	Statements	SA (%)	A (%)	N (%)	DA (%)	SDA (%)	Total
1	I frequently use digital tools in my teaching activities.	50 (21%)	85 (36%)	60 (26%)	30 (13%)	10 (4%)	235
2	I regularly incorporate technology into lesson planning.	45 (19%)	90 (38%)	60 (26%)	30 (13%)	10 (4%)	235
3	I use online platforms to communicate with students outside of class hours.	55 (23%)	80 (34%)	65 (28%)	25 (11%)	10 (4%)	235
4	I frequently update and maintain my digital resources and tools.	45 (19%)	85 (36%)	65 (28%)	30 (13%)	10 (4%)	235
5	I actively seek out new technology to enhance my teaching practices.	50 (21%)	80 (34%)	60 (26%)	30 (13%)	15 (6%)	235

The data in Table 3 shows the usage patterns of digital tools among educators. A significant proportion of respondents, 57%, frequently use digital tools in their teaching activities (21% strongly agree and 36% agree). Additionally, 57% regularly incorporate technology into lesson planning (19% strongly agree and 38% agree). Communication with students outside of class hours via online platforms is reported by 57% of respondents (23% strongly agree and 34% agree). Regarding the maintenance of digital resources, 55% frequently update and maintain their tools (19% strongly agree and 36% agree). Lastly, 55% of educators actively seek out new technology to enhance their teaching practices (21% strongly agree and 34% agree). These results indicate a robust integration of digital tools in educational practices, though there remains a smaller proportion of educators who do not engage as frequently with these technologies.

RQ. 2: What are the primary challenges educators face in integrating technology into their curriculum, and how do these challenges affect their professional development needs?

Table 4. Perceived Challenges

No	Statements	SA (%)	A (%)	N (%)	DA (%)	SDA (%)	Total
1	I find it challenging to keep up with new technological advancements.	40 (17%)	85 (36%)	60 (26%)	30 (13%)	20 (9%)	235
2	I often encounter technical difficulties that disrupt my teaching.	45 (19%)	80 (34%)	55 (23%)	35 (15%)	20 (9%)	235
3	I struggle with integrating technology effectively into my curriculum.	50 (21%)	75 (32%)	65 (28%)	30 (13%)	15 (6%)	235
4	I feel that there are not enough resources available to address my technological needs.	55 (23%)	80 (34%)	60 (26%)	25 (11%)	15 (6%)	235
5	I face difficulties in ensuring that all students have equal access to technology.	50 (21%)	85 (36%)	55 (23%)	20 (9%)	25 (11%)	235

The data in Table 4 shows the perceived challenges faced by educators regarding technology. A substantial proportion of respondents, 53%, find it challenging to keep up with new technological advancements (17% strongly agree and 36% agree). Technical difficulties that disrupt teaching are encountered by 53% of respondents (19% strongly agree and 34% agree). Additionally, 53% struggle with effectively integrating technology into their curriculum (21% strongly agree and 32% agree). A similar proportion, 57%, feel that there are insufficient resources to meet their technological needs (23% strongly agree and 34% agree). Lastly, 57% face difficulties in ensuring all students have equal access to technology (21% strongly agree and 36% agree). These findings highlight the significant obstacles educators face in adapting to and utilizing technology effectively in their teaching practices.

Table 5. Professional Development Needs

No	Statements	SA (%)	A (%)	N (%)	DA (%)	SDA (%)	Total
1	I need more training on using advanced digital tools for teaching.	55 (23%)	80 (34%)	60 (26%)	30 (13%)	10 (4%)	235
2	I require support in developing skills to integrate technology effectively into my lessons.	50 (21%)	85 (36%)	60 (26%)	25 (11%)	15 (6%)	235
3	I would benefit from workshops on managing and troubleshooting technology issues.	55 (23%)	75 (32%)	65 (28%)	30 (13%)	10 (4%)	235
4	I seek more opportunities for professional development related to digital literacy.	60 (26%)	70 (30%)	65 (28%)	25 (11%)	15 (6%)	235

5	I need guidance on how to evaluate and select appropriate technology for educational purposes.	50 (21%)	80 (34%)	65 (28%)	25 (11%)	15 (6%)	235
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The data in Table 5 shows the professional development needs of educators concerning technology use. A significant majority, 57%, feel they need more training on using advanced digital tools for teaching (23% strongly agree and 34% agree). Additionally, 57% require support in developing skills to integrate technology effectively into their lessons (21% strongly agree and 36% agree). Workshops on managing and troubleshooting technology issues are sought by 55% of respondents (23% strongly agree and 32% agree). Furthermore, 56% seek more opportunities for professional development related to digital literacy (26% strongly agree and 30% agree). Lastly, 55% need guidance on evaluating and selecting appropriate technology for educational purposes (21% strongly agree and 34% agree). These results underscore the substantial demand for targeted professional development to enhance educators' technological competencies and support their integration of digital tools into teaching practices.

DISCUSSION

The aim of this research is to explore the digital literacy and competence of educators who teach in coastal area of Indonesia. The first research question of the study seeks to explore how technology access and usage patterns among educators influence their ability to integrate digital tools into their teaching practices. Our findings reveal a generally positive trend in technology access among educators, though some challenges persist. Most educators have reliable access to computers or laptops and high-speed internet, which supports their professional tasks effectively. This observation aligns with the findings of Song et al. (2022), who advocated that stable hardware and high-speed connectivity are fundamental for effective digital integration in education. Additionally, many respondents have access to online resources and tools for teaching and learning, indicating a good level of resource availability. This is supported by Falloon (2020), who noted that a broad range of digital resources significantly enhances teaching practices and learning outcomes. However, there are notable gaps in access to up-to-date software and applications. While many educators can utilize current technologies, a portion still faces difficulties with consistent access to the latest tools and resources. This finding echoes the concerns raised by Joshi et al. (2021), who highlighted that discrepancies in software availability can hinder educators' ability to fully utilize technology in their classrooms. Similarly, Neumeyer et al. (2020) reported that inadequate access to updated software poses a significant barrier to effective technology integration. Addressing these gaps is essential for ensuring that all educators can fully leverage technology in their teaching practices. Recent studies, such as those by Darling-Hammond and Hyler (2020) and Fairman et al. (2022), emphasize the need for comprehensive support and updated resources to bridge these gaps and promote equitable technology use among educators.

Furthermore, we also found that a majority of participants highlight a strong trend towards the integration of digital tools among educators. A significant number of educators frequently use digital tools in their teaching activities and incorporate technology into lesson planning. This trend is supported by Haleem et al. (2022), who found that frequent use of digital tools significantly enhances teaching efficiency and lesson planning effectiveness. Additionally, many educators engage in communication with students outside of class hours via online platforms, and regularly update and maintain their digital resources. This finding is consistent with the research of Demestichas and Daskalakis (2022), who noted that ongoing communication and resource maintenance are key components of effective technology integration. There is also a notable trend of educators actively seeking out new technology to enhance their teaching practices. This proactive approach aligns with the observations of Uzumcu and Acilmis (2024), who highlighted that educators who actively seek and adopt new technologies are more likely to innovate in their teaching methods. Despite these positive trends, a smaller proportion of educators do not engage as frequently with these technologies. This suggests that while digital tools are robustly integrated into educational practices for many, gaps remain in broader adoption. This discrepancy is in line with the findings of Reich (2020), who pointed out that uneven technology adoption can create disparities in educational practices and outcomes. Addressing these gaps is crucial for achieving more widespread and equitable integration of digital tools in education.

The next significant findings of our research focus on the primary challenges educators face in integrating technology into their curriculum and how these challenges affect their professional development needs. We observed several substantial obstacles in adapting to technology. A notable trend is the difficulty educators experience in keeping up with new technological advancements and managing technical issues that disrupt their teaching. This aligns with the findings of Nuere and De Miguel (2021), who noted that staying current with technological changes is a major challenge for educators and often leads to disruptions in teaching. Additionally, many educators struggle with effectively integrating technology into their curriculum. This difficulty is compounded by barriers such as insufficient resources and unequal access for students, which are consistent with the concerns raised by Hamutoğlu and Başarmak (2020), who highlighted that these barriers can significantly hinder the integration process. These findings underscore the substantial obstacles that educators encounter in utilizing technology effectively. The need for targeted support and resources is evident, as emphasized by Martinez (2024), who argued that addressing these challenges is critical for improving technological integration in educational practices. The impact of these challenges on educators' professional development needs also points to a broader requirement for comprehensive training and support systems. This is supported by Kato et al. (2020), who found that tailored professional development programs are essential for overcoming barriers to technology integration and enhancing educators' ability to leverage digital tools effectively in their teaching.

Next, our findings reveal a strong trend towards the need for enhanced professional development among educators concerning technology use. A significant majority of educators express a demand for more training on advanced digital tools and support in integrating technology into their lessons. This trend is supported by Bragg et al., (2021), who highlighted that targeted training on advanced tools is crucial for improving educators' technological skills and enhancing their teaching effectiveness. Additionally, there is a notable need for workshops on managing and troubleshooting technology issues. This aligns with the observations of Kruszewska et al. (2022), who found that educators often face technical difficulties that can disrupt their teaching and require specialized training to address. Furthermore, educators seek more opportunities for professional development in digital literacy. This need is corroborated by Sánchez-Cruzado et al. (2021), who emphasized that ongoing development in digital literacy is essential for educators to stay current with technological advancements and effectively use digital tools in their teaching. Additionally, there is a demand for guidance on evaluating and selecting appropriate technology for educational purposes. This need for proper technology selection is consistent with the findings of Bereczki and Kárpáti (2021), who noted that appropriate technology evaluation is critical for effective integration into educational settings. These findings underscore a substantial demand for targeted professional development to bolster educators' technological competencies and support their effective integration of digital tools into their teaching practices. Addressing these needs is essential for equipping educators with the skills and resources necessary to navigate and utilize technology effectively in their classrooms, as highlighted by recent studies on technology integration and educator support (Bowman et al., 2022; Smith and Gillespie, 2023).

The findings of this research highlight the critical role of technology access and usage patterns in shaping educators' ability to integrate digital tools into their teaching practices. The generally positive trend in technology access among educators suggests that, while many have the resources necessary for effective digital integration, significant gaps remain. These gaps, particularly in accessing up-to-date software, underscore the need for targeted interventions to ensure equitable access to the latest technological advancements. The strong trend towards digital tool integration among educators indicates that many are embracing technology to enhance their teaching. However, the variation in technology adoption rates suggests that additional support is needed to bridge the gaps in technology use across different educational settings. Addressing these issues can enhance teaching practices, improve educational outcomes, and support more widespread and equitable integration of technology in education.

One primary limitation of this research is its reliance on survey data with a relatively small sample size, which may not fully represent the diverse experiences of educators across all regions of Indonesia. Additionally, the study's geographic scope is limited, potentially excluding significant variations in technology access and integration practices across different areas. To address these limitations, future research should include larger,

more diverse samples and cover a broader range of geographic locations. This will provide a more comprehensive understanding of the challenges and needs related to technology integration in various educational contexts. Expanding the research scope and sample size will help ensure that findings are more representative and applicable to a wider range of educational settings, leading to more effective and targeted recommendations for improving technology integration in Indonesian education.

CONCLUSION

This research aimed to explore the digital literacy and competence of educators in coastal areas of Indonesia, focusing on their technology access, usage patterns, and challenges in integrating digital tools into their teaching practices. The study revealed a generally positive trend in technology access among educators, with reliable access to computers, laptops, and internet connection supporting their professional tasks. Despite these positive trends, gaps remain in accessing up-to-date software, indicating a need for improved support and resources to ensure equitable technology use. Our findings also highlight a robust trend towards integrating digital tools in teaching, with many educators actively using technology in lesson planning and communication with students. However, the uneven adoption of these tools suggests that further efforts are needed to achieve broader and more equitable technology integration. The research also identified significant challenges educators face, including difficulties in keeping up with technological advancements and managing technical issues. These obstacles underscore the need for comprehensive professional development and support. There is a notable demand for targeted training on advanced digital tools and troubleshooting to enhance educators' technological competencies. Despite its valuable insights, this study is limited by its small sample size and geographic scope, which may not fully represent the diverse experiences of educators across Indonesia. Future research should expand the sample size and include a broader range of geographic locations to provide a more comprehensive understanding of technology integration challenges. Addressing these limitations will enhance the applicability of findings and support more effective recommendations for improving technology integration in education.

REFERENCES

- Annan, J. K. (2020). Preparing globally competent teachers: A paradigm shift for teacher education in Ghana. *Education Research International*, 2020(1), 8841653.
- Anthonyamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. *Education and Information Technologies*, 25(4), 2393-2414.
- Arnhold, N., & Bassett, R. M. (2021). Steering Tertiary Education: Toward Resilient Systems That Deliver for All. World Bank.
- Baldacchino, G. (2020). How far can one go? How distance matters in island development. *Island Studies Journal*, 15(1), 25-42.
- Basso, F., Frez, J., Martínez, L., Pezoa, R., & Varas, M. (2020). Accessibility to opportunities based on public transport gps-monitored data: The case of Santiago, Chile. *Travel Behaviour and Society*, 21, 140-153.
- Bejaković, P., & Mrnjavac, Ž. (2020). The importance of digital literacy on the labour market. *Employee Relations: The International Journal*, 42(4), 921-932.
- Bereczki, E. O., & Kárpáti, A. (2021). Technology-enhanced creativity: A multiple case study of digital technology-integration expert teachers' beliefs and practices. *Thinking Skills and Creativity*, 39, 100791.
- Bowman, M. A., Vongkulluksn, V. W., Jiang, Z., & Xie, K. (2022). Teachers' exposure to professional development and the quality of their instructional technology use: The mediating role of teachers' value and ability beliefs. *Journal of Research on Technology in Education*, 54(2), 188-204.
- Bragg, L. A., Walsh, C., & Heyeres, M. (2021). Successful design and delivery of online professional development for teachers: A systematic review of the literature. *Computers & Education*, 166, 104158.
- Braun, V., Clarke, V., Boulton, E., Davey, L., & McEvoy, C. (2021). The online survey as a qualitative research tool. *International journal of social research methodology*, 24(6), 641-654.
- Buchholz, B. A., DeHart, J., & Moorman, G. (2020). Digital citizenship during a global pandemic: Moving beyond digital literacy. *Journal of Adolescent & Adult Literacy*, 64(1), 11-17.
- Darling-Hammond, L., & Hyler, M. E. (2020). Preparing educators for the time of COVID... and beyond. *European Journal of Teacher Education*, 43(4), 457-465.
- Demestichas, K., & Daskalakis, E. (2020). Information and communication technology solutions for the circular economy. *Sustainability*, 12(18), 7272.
- Fairman, J. C., Smith, D. J., Pullen, P. C., & Lebel, S. J. (2022). The challenge of keeping teacher professional development relevant. In *Leadership for Professional Learning* (pp. 251-263). Routledge.
- Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational technology research and development*, 68(5), 2449-2472.

- Ferreira, J. C., Vasconcelos, L., Monteiro, R., Silva, F. Z., Duarte, C. M., & Ferreira, F. (2021). Ocean literacy to promote sustainable development goals and agenda 2030 in coastal communities. *Education Sciences*, 11(2), 62.
- Green, C., Mynhier, L., Banfill, J., Edwards, P., Kim, J., & Desjardins, R. (2020). Preparing education for the crises of tomorrow: A framework for adaptability. *International Review of Education*, 66, 857-879.
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable operations and computers*, 3, 275-285.
- Hamutoğlu, N. B., & Başarmak, U. (2020). External and internal barriers in technology integration: A structural regression analysis.
- Istifci, I., & Goksel, N. (2022). The relationship between digital literacy skills and self-regulated learning skills of open education faculty students. *English as a Foreign Language International Journal*, 2(1), 59-81.
- Johnson, F. A., Eaton, M. J., Mikels-Carrasco, J., & Case, D. (2020). Building adaptive capacity in a coastal region experiencing global change. *Ecology & Society*, 25(3).
- Joshi, A., Vinay, M., & Bhaskar, P. (2021). Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments. *Interactive technology and smart education*, 18(2), 205-226.
- Kato, N., Mao, B., Tang, F., Kawamoto, Y., & Liu, J. (2020). Ten challenges in advancing machine learning technologies toward 6G. *IEEE Wireless Communications*, 27(3), 96-103.
- Kim How, R. P. T., Zulnaidi, H., & Abdul Rahim, S. S. (2022). The Importance of Digital Literacy in Quadratic Equations, Strategies Used, and Issues Faced by Educators. *Contemporary Educational Technology*, 14(3).
- Kruszewska, A., Nazaruk, S., & Szweczyk, K. (2022). Polish teachers of early education in the face of distance learning during the COVID-19 pandemic—the difficulties experienced and suggestions for the future. *Education 3-13*, 50(3), 304-315.
- Liang, W., Zhang, Y., Cao, H., Wang, B., Ding, D. Y., Yang, X., ... & Zou, J. (2024). Can large language models provide useful feedback on research papers? A large-scale empirical analysis. *NEJM AI*, AIoa2400196.
- Lim, J., & Newby, T. J. (2021). Preservice teachers' attitudes toward Web 2.0 personal learning environments (PLEs): Considering the impact of self-regulation and digital literacy. *Education and Information Technologies*, 26(4), 3699-3720.
- Liu, Z. J., Tretyakova, N., Fedorov, V., & Kharakhordina, M. (2020). Digital literacy and digital didactics as the basis for new learning models development. *International Journal of Emerging Technologies in Learning*.
- Morgan, A., Sibson, R., & Jackson, D. (2022). Digital demand and digital deficit: conceptualising digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management*, 44(3), 258-275.
- Neumeyer, X., Santos, S. C., & Morris, M. H. (2020). Overcoming barriers to technology adoption when fostering entrepreneurship among the poor: The role of technology and digital literacy. *IEEE Transactions on Engineering Management*, 68(6), 1605-1618.
- Nuere, S., & De Miguel, L. (2021). The digital/technological connection with COVID-19: An unprecedented challenge in university teaching. *Technology, Knowledge and learning*, 26(4), 931-943.
- Pangrazio, L., Godhe, A. L., & Ledesma, A. G. L. (2020). What is digital literacy? A comparative review of publications across three language contexts. *E-learning and Digital Media*, 17(6), 442-459.
- Porru, S., Misso, F. E., Pani, F. E., & Repetto, C. (2020). Smart mobility and public transport: Opportunities and challenges in rural and urban areas. *Journal of traffic and transportation engineering (English edition)*, 7(1), 88-97.
- Raygan, A., & Moradkhani, S. (2022). Factors influencing technology integration in an EFL context: investigating EFL teachers' attitudes, TPACK level, and educational climate. *Computer Assisted Language Learning*, 35(8), 1789-1810.
- Reich, J. (2020). *Failure to disrupt: Why technology alone can't transform education*. Harvard University Press.
- Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compañá, M. T. (2021). Teacher digital literacy: The indisputable challenge after COVID-19. *Sustainability*, 13(4), 1858.
- Smith, C., & Gillespie, M. (2023). Research on professional development and teacher change: Implications for adult basic education. In *Review of Adult Learning and Literacy*, Volume 7 (pp. 205-244). Routledge.
- Song, F., Li, L., You, I., Yu, S., & Zhang, H. (2022). Optimizing high-speed mobile networks with smart collaborative theory. *IEEE Wireless Communications*, 29(3), 48-54.
- Tejedor, S., Cervi, L., Pérez-Escoda, A., & Jumbo, F. T. (2020). Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador. *Publications*, 8(4), 48.
- Ting, K. H., Cheng, C. T., & Ting, H. Y. (2021). Introducing the problem/project based learning as a learning strategy in University Social Responsibility Program-A study of local revitalization of Coastal Area, Yong-An District of Kaohsiung City. *Marine Policy*, 131, 104546.
- Uzumcu, O., & Acilmis, H. (2024). Do innovative teachers use AI-powered tools more interactively? a study in the context of diffusion of innovation theory. *Technology, Knowledge and Learning*, 29(2), 1109-1128.
- Wang, D., Zhou, T., & Wang, M. (2021). Information and communication technology (ICT), digital divide and urbanization: Evidence from Chinese cities. *Technology in Society*, 64, 101516.
- Wohlfart, O., Trumler, T., & Wagner, I. (2021). The unique effects of Covid-19—A qualitative study of the factors that influence teachers' acceptance and usage of digital tools. *Education and Information Technologies*, 26(6), 7359-7379.