International Journal of Learning Reformation in Elementary Education
Vol. 4, No. 03, pp. 265-283
journal.iistr.org/index.php/IJLREE
DOI: 10.56741/ijlree.v4i03.1157

Systematic Literature Review: Digital Literacy in the Classroom Teaching

[1]Elsa Viona*, [2]Sudarwan Danim, [3]Rosane Medriati, [4]Muhammad Kristiawan, [5]Edy Susanto, [5]Sheren Dwi Oktaria, [7]Julie Simon Macariola
Corresponding Author: * elsavionaona29@gmail.com
[1] University of Bengkulu, Bengkulu, Indonesia
[2] University of Pat Petulai, Bengkulu, Indonesia
[3] University of Lampung, Lampung, Indonesia
[4] Shinawatra University, Pathum Thani, Thailand

ARTICLE INFO

Article history
Received 6 July 2025
Revised 16 September 2025
Accepted 19 September 2025

ABSTRACT

Digital literacy is not just an additional skill but a basic need that every individual must have in the modern era. This systematic literature review aims to identify the most effective strategies in improving digital literacy in the field of teaching. The stages of this review follow the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting standards by searching academic literature through the Scopus database. The included studies meet the criteria that the articles were published between 2024, the studies were written in English, and open access and social sciences were the subject areas. The results of the study found 91 publications related to digital literacy in teaching. The research trend shows a significant increase from year to year. This indicates the increasing attention and urgency of this topic among researchers. A total of 42 countries were identified as the origin of publications, with Indonesia as the country of origin of the most publications. In addition, the main themes were not to be related to potential strategies for digital literacy in teaching, ranging from the use of advanced technology to empowering teachers and students. These strategies aim to create an inclusive, adaptive, and collaborative learning environment where technology becomes a tool to support meaningful learning. By ensuring effective technology integration, adequate teacher training, equity of access, and the use of collaborative teaching methods, digital literacy can become a key foundation for educational success in the digital age.

Keywords
Classroom Teaching
Digital Literacy
Elementary Education
Literature Review

Introduction

The digital era has changed the way humans communicate, learn, and work. In the field of education, the development of information and communication technology has brought new opportunities and challenges, especially in efforts to improve digital literacy among educators and students [1]. Digital literacy, which includes the ability to find, evaluate, and use information effectively in a digital environment, is now an essential skill that must be mastered by every individual [2]. In the context of teaching, digital literacy has an important role in creating learning that is more interactive, relevant, and in accordance with the needs of the times [3]. The focus of studies related to digital literacy in the field of education has grown rapidly along with technological developments [4].

Digital literacy is no longer limited to technical mastery of technological devices, but also includes ethical, critical, and creative understanding in using technology to support learning [5], [6]. According Bender [7], digital literacy is associated with higher-order thinking skills, such as information literacy, media literacy, and the ability to solve problems collaboratively through technology. In addition, McGrew and Breakstone [8] revealed that digital literacy is now also an integral part of the curriculum in various countries, which is designed to help students not only as users of technology, but also as productive and responsible creators of digital content. Studies Nikitina [9] and Petrovic-Dzerdz & Trépanier [10] related to digital literacy also increasingly highlight how technology can be a bridge to overcome various learning obstacles, including geographic, social, and economic disparities.

Digital literacy strategies in teaching include a variety of approaches designed to empower educators and students to make optimal use of technology. One strategy that is widely used is the integration of technology into the teaching and learning process, such as the use of Learning Management Systems [11], online learning applications [12], and social media [13] to improve interaction between teachers and students. In addition, digital project-based learning approaches have been shown to be effective in developing critical thinking and collaboration skills among students [14], [15]. Not only that, digital literacy training for teachers is also a major focus to ensure that they have sufficient competence to guide students in using technology wisely and responsibly [16], [17], [18].

The challenges of digital literacy in teaching cannot be ignored; the low level of digital literacy among educators and students is a barrier to the implementation of technology-based learning strategies [19]. Digital literacy is not just an additional skill but a basic need that every individual must have in the modern era [20]. With the right strategy and joint efforts to overcome existing challenges, digital literacy can be a strong foundation for more innovative, relevant, and meaningful teaching [21]. In this study, particular attention is given to the aspects of classroom teaching most frequently discussed in the literature. These aspects include technology integration, teacher professional development, equity of access, collaborative learning, and adaptability of teaching frameworks. They were selected because they consistently emerged across prior studies as key dimensions for improving digital literacy in classroom contexts. Technology integration enables personalized and interactive learning experiences, while teacher professional development ensures that educators are equipped to guide students effectively in digital environments. At the same time, addressing equity of access is crucial to bridge the digital divide and provide fair opportunities for all learners. Building on this foundation, collaborative learning fosters teamwork, communication, and problem-solving skills through digital platforms, and the adaptability of teaching frameworks ensures that schools and teachers remain responsive to ongoing technological change. Together, these aspects provide a comprehensive lens for examining strategies and challenges in promoting digital literacy in classroom contexts.

By conducting a systematic literature review, this study aims to identify the most effective strategies in improving digital literacy in teaching. Specifically, the review addresses the following research questions: (1) What strategies have been implemented to improve digital literacy in classroom teaching? (2) What challenges are commonly encountered in the implementation of digital literacy strategies?. The results of this study are expected to provide concrete recommendations for educators, policymakers, and educational institutions to create a more inclusive and adaptive learning ecosystem for the digital era.

Material and Methods

The method used in this study is a systematic literature review, an approach that aims to identify, evaluate, and synthesize relevant research findings on digital literacy strategies and challenges in teaching. A systematic literature review is conducted by following several structured stages to ensure the validity and relevance of the findings obtained [22]. As part of the validation process, this literature review refers to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting standards to ensure transparency and quality of the methods used. According to Gough and Richardson [22], the PRISMA stages include presenting a literature search flowchart, the number of articles selected, and the

reasons for excluding certain articles. The literature search was conducted using a trusted academic database, namely Scopus. Using the Scopus database because this database only includes high-quality journals and publications that have gone through a rigorous peer-review process. The articles in it are considered to have high academic standards and are relevant to scientific research. According to Shestakova et al. [23], Scopus covers more than seventy million articles from thousands of international journals in various fields of science, including education. This allows researchers to gain access to comprehensive and relevant literature on the topic being studied.

Keywords used in the search include "digital literacy," "learning," "teachers," and "students." According to Merrydian et al. [24], after identification, screening is carried out to sharpen the search results by setting inclusion criteria to select relevant studies. Included studies must meet the criteria that journal articles be published in the last 10 years (2014–2024), studies be written in English, studies be open access, and the subject area be social sciences. Exclusion criteria include articles that only discuss digital literacy in general without a teaching context. Articles found through the database are evaluated in stages. Selection is carried out by reading the title and abstract first to assess suitability with the inclusion criteria [25]. This process is carried out in layers to ensure that only articles that meet the relevance and quality criteria are included. Relevant articles were then analyzed in depth based on their full content. To ensure transparency, the inclusion and exclusion criteria applied in this review are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Criteria Type	Description
Inclusion	• Journal articles published between 2014–2024 • Written in English • Open access • Indexed in Scopus • Subject area: Social Sciences • Focus on digital literacy in classroom teaching context
Exclusion	• Articles not related to teaching context (e.g., only general digital literacy) • Non-English publications • Non-open access publications • - Articles outside the range of 2014–2024

Data from each article was coded and categorized based on key themes, such as digital literacy strategies, challenges, and contexts of implementation. After the thematic analysis was completed, the research findings were synthesized to provide a comprehensive picture of digital literacy strategies and challenges in teaching.

The synthesis aimed to highlight best practices in improving digital literacy among teachers and students, identify key barriers and solutions that have been attempted to address

these challenges, and provide practical and theoretical recommendations for further research or implementation. See Fig. 1.

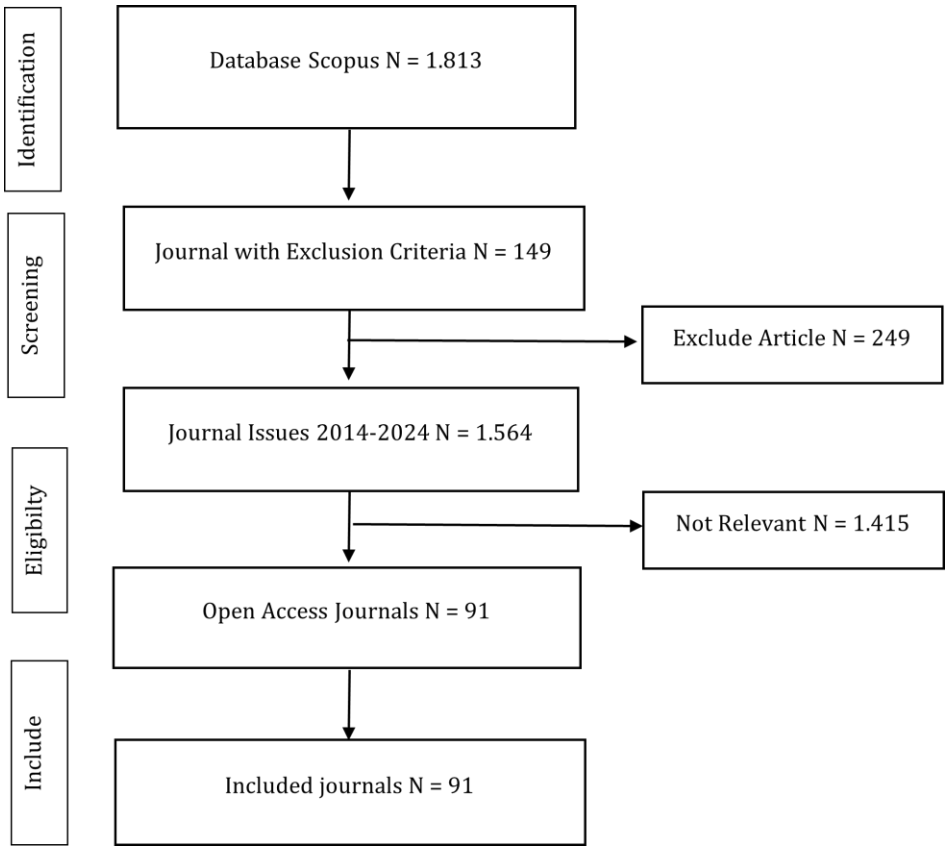

Fig. 1. PRISMA Flowchart

Results and Discussions

A. Journals or articles published in Scopus

Journals or articles published in Scopus related to digital literacy strategies and challenges in teaching found 91 relevant articles. Fig. 2 shows a significant trend.

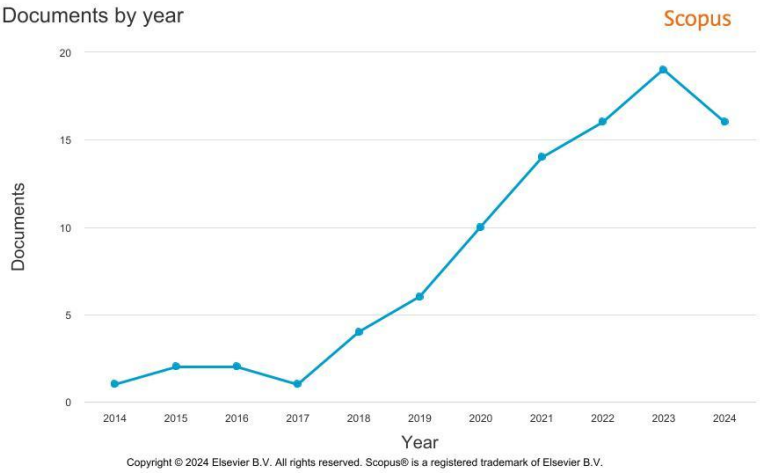

Fig. 2. Publication information from 2014-2024

The trend of publications related to digital literacy in teaching shows a significant increase from year to year, with the growth reflecting the increasing attention and urgency of this topic among researchers. In 2014 and 2015, research on digital literacy was still very limited, with only one and two publications produced, respectively. This indicates that during that period, the topic of digital literacy may not have been a major concern in the world of education. However, from 2016 to 2018, the number of publications began to increase gradually, although still in relatively small numbers, namely 2 publications in 2016, 1 publication in 2017, and 4 publications in 2018. This period can be considered the initial stage of increasing awareness of the importance of digital literacy in teaching. A more significant increase occurred starting in 2019, where the number of publications reached 6, and continued to increase to 10 in 2020. This increase could be influenced by the increasingly rapid development of educational technology, especially with the increasing adoption of digital devices in the learning process.

This trend has strengthened in the following years, with publications reaching 14 in 2021 and jumping to 16 in 2022. The peak occurred in 2023 and 2024, with 19 and 16 publications, respectively. The spike in this period was likely driven by the COVID-19 pandemic, which forced many educational institutions to adopt digital technology massively in learning activities. The pandemic has not only accelerated the digital transformation in the world of education but also encouraged more research related to digital literacy strategies and challenges. These data show that digital literacy has become one of the increasingly relevant topics and has received attention in the field of education in recent years. The increasing trend in publications also reflects the need to develop better strategies for integrating digital literacy into teaching and efforts to overcome the various challenges that arise in its implementation.

B. The country of origin of publication

Fig. 3 shows the country of origin of publication of articles on digital literacy in teaching, showing that the contribution of this research is spread across the world, with a total of 42 countries identified as the origin of publications. This data reflects that the issue of digital literacy is a global concern that attracts the interest of many researchers from various countries. Of the list of 42 countries, Indonesia is the country with the highest contribution of publications, namely 18 documents. This shows that digital literacy has high relevance in Indonesia, both as a response to the challenges of digital transformation in education and as a need to improve the quality of learning in the technological era. The second position is filled by Spain and the United States, each with 9 publications. These two countries have a long history of adopting technology in education, so it is not surprising that they are active in publishing research on digital literacy. Australia is in third place with 8 documents, showing its commitment to the integration of digital literacy in the education sector. As a country with

advanced digital infrastructure, Australia seems to continue to invest in research and development related to digital literacy.

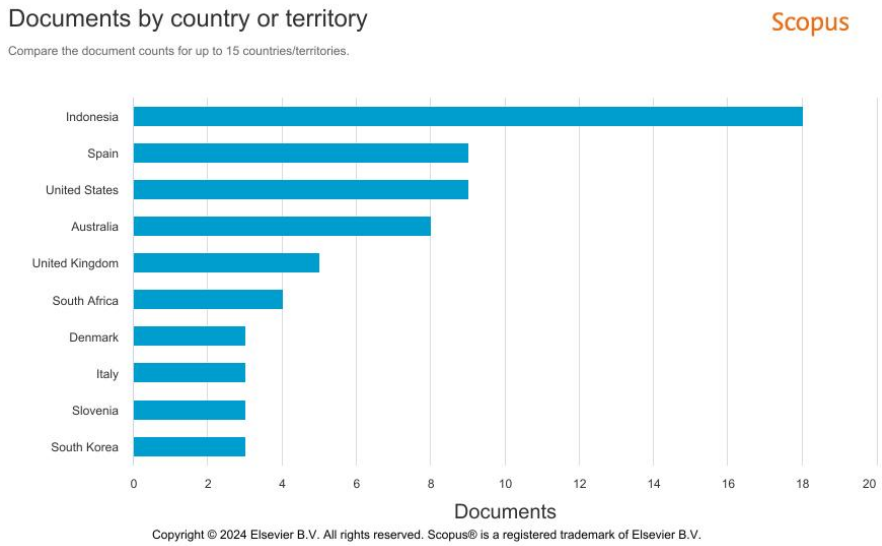

Fig. 3. Publications by Country

The United Kingdom is in fourth place with 5 publications. As one of the global education and research hubs, the UK has made a significant contribution, although the number is still lower compared to other countries in the top list. South Africa follows in fifth place with 4 publications. This shows that there is increasing attention to digital literacy in the African region, especially in efforts to reduce the digital divide and increase access to quality education through technology. Denmark, Italy, Slovenia, and South Korea each contributed 3 publications. These countries show that although their contributions are not as large as the top countries, they are still active in research related to digital literacy.

C. The sources of publications

Fig. 4 shows the sources of publications related to digital literacy in teaching, showing the diversity of journals and academic platforms used to publish research in this field. Of the total 72 sources identified, there are 10 top publication sources that have made significant contributions to disseminating research and development results related to digital literacy. Education Sciences is in the top position with 5 publications. This journal has a main focus on various education issues, including the adoption of digital technology and innovation in teaching, making it a relevant platform for researchers studying digital literacy.

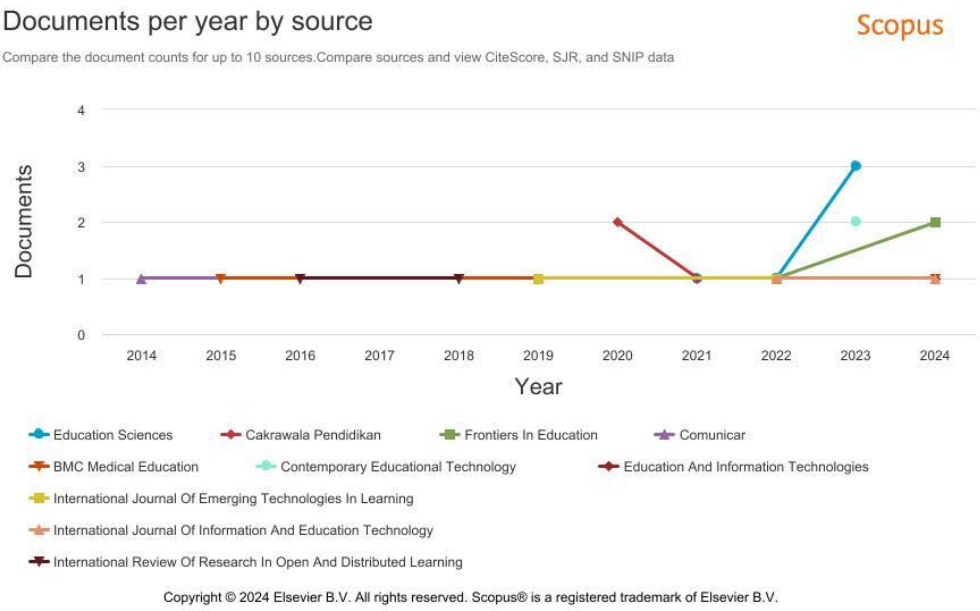

Fig. 4. Publication Sources from 2014-2024

The second position is filled by three sources, each with 3 publications, namely Cakrawala Pendidikan, Frontiers in Education, and BMC Medical Education. Furthermore, there are several sources with 2 publications each that have made significant contributions to digital literacy literature: Comunicar, Contemporary Educational Technology and Education and Information Technologies, International Journal of Emerging Technologies in Learning, International Journal of Information and Education Technology, and International Review of Research in Open and Distributed Learning.

The diversity of these publication sources reflects that research on digital literacy in teaching is not limited to one educational context but involves various disciplines such as general education, educational technology, and special education, such as the medical field. In addition, the contribution of international and local journals, such as Cakrawala Pendidikan, shows that this topic is relevant in various regions of the world, both in developed and developing countries.

Fig. 4 shows the sources of publications related to digital literacy in teaching, showing the diversity of journals and academic platforms used to publish research in this field. Of the total 72 sources identified, there are 10 top publication sources that have made significant contributions to disseminating research and development results related to digital literacy. Education Sciences is in the top position with 5 publications. This journal has a main focus on various education issues, including the adoption of digital technology and innovation in teaching, making it a relevant platform for researchers studying digital literacy. The second position is filled by three sources, each with 3 publications, namely Cakrawala Pendidikan, Frontiers in Education, and BMC Medical Education.

Furthermore, there are several sources with 2 publications each that have made significant contributions to digital literacy literature: Comunicar, Contemporary Educational Technology and Education and Information Technologies, International Journal of Emerging Technologies in Learning, International Journal of Information and Education Technology, and International Review of Research in Open and Distributed Learning. The diversity of these publication sources reflects that research on digital literacy in teaching is not limited to one educational context but involves various disciplines such as general education, educational technology, and special education, such as the medical field. In addition, the contribution of international and local journals, such as Cakrawala Pendidikan, shows that this topic is relevant in various regions of the world, both in developed and developing countries.

D. Author Affiliation

Fig. 5 shows that articles on digital literacy in teaching come from contributions from academics affiliated with 145 universities and educational institutions worldwide. From the data, there are 10 top universities that show active participation in research on this topic. Malang State University is the institution with the largest number of publication contributions, namely 4 documents.

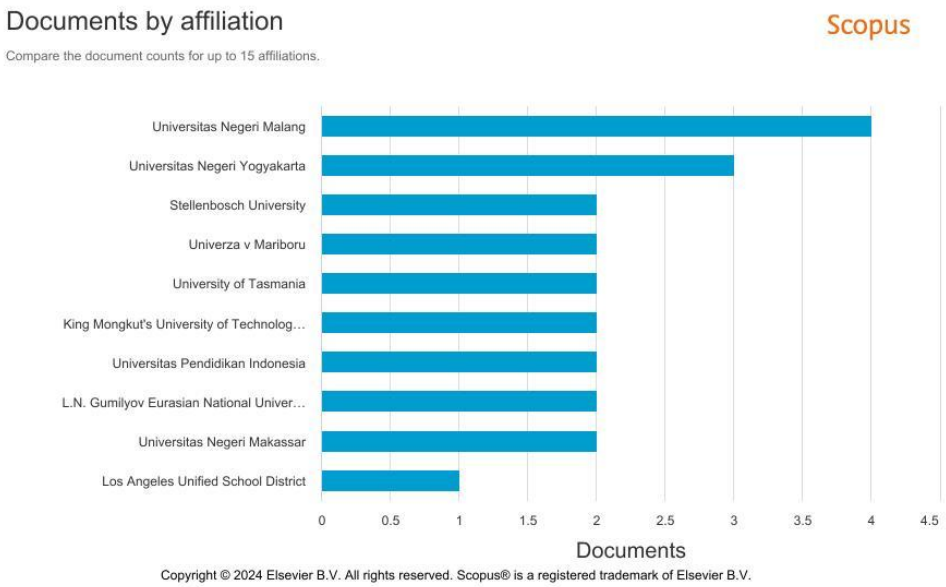

Fig. 5. Affiliation of Articles with Universities

In second place, Yogyakarta State University is ranked with 3 publications. Furthermore, there are several universities that each contribute 2 publications: Stellenbosch University in South Africa, Univerza v Mariboru (University of Maribor) in Slovenia, University of Tasmania in Australia, King Mongkut's University of Technology North Bangkok in Thailand, Indonesia University of Education (UPI), L.N. Gumilyov Eurasian National University in Kazakhstan, and Makassar State University. This data shows that digital literacy in teaching is a global issue that

involves contributions from universities from various regions of the world. The involvement of Indonesian universities such as Malang State University, Yogyakarta State University, Indonesian Education University, and Makassar State University reflects the high attention of developing countries to technology-based educational transformation. On the other hand, universities in developed countries and other regions also play an active role, enriching global perspectives in addressing challenges and developing effective digital literacy strategies.

E. The top 10 authors

Fig. 6 shows the top 10 authors with the most publications in this field. Among the top authors are Ambersek MK, Afriliasanti, Basthomi, Nilsook, Zen, and Abusiri, who each have 3 publications. Other authors, such as Abersek B, Abidinova G, Adang C, and Aguaded, each have 2 publications.

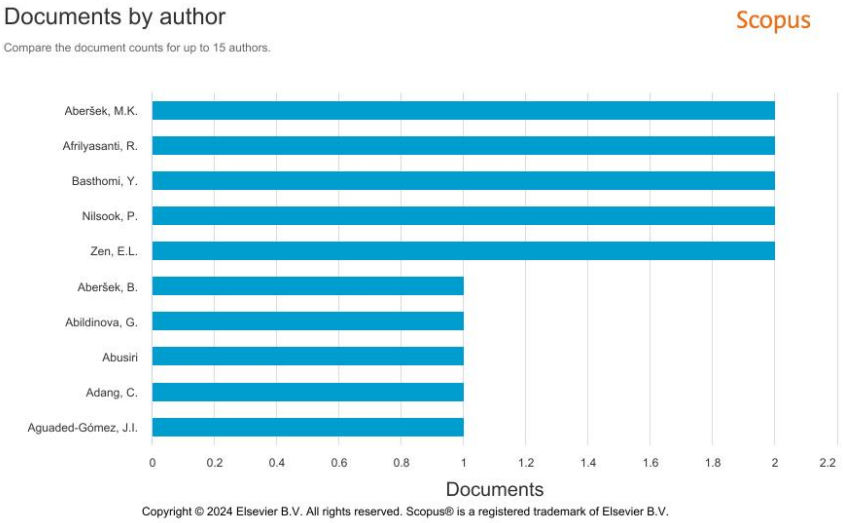

Fig. 6. Top Publications by author

Overall, these top authors reflect a diversity of backgrounds and research contexts that enrich the discussion on digital literacy in teaching. The presence of authors from various countries, including Indonesia, shows that the issue of digital literacy is not only a concern for developed countries but is also very relevant for developing countries. The contributions of these authors provide an important foundation for developing technology-based education strategies and policies while also providing practical solutions to address digital literacy challenges at various levels of education.

F. The highest number of citations

Table 2 shows the highest number of citations related to digital literacy in teaching. Falloon [26] is the article with the highest number of citations, which is 457 citations, and the study by [27] has 152 citations. These articles are believed to be important milestones in the digital literacy literature, focusing on the adaptation of online learning during the COVID-19 pandemic.

Table 2. Top 10 Articles with the Most Citations

No.	Title	Source	Publisher	Citations	Reference Number
1.	From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework	Educational Technology Research and Development	Springer	457	[26]
2.	Digital Literacy and Higher Education during COVID-19 Lockdown: Spain, Italy, and Ecuador	Publications	MDPI AG	152	[27]
3.	Teachers' Conceptualization and Enactment of Twenty-First Century Competences: Exploring Dimensions for New Curricula	Curriculum Journal	Routledge	93	[28]
4.	Difficulties in Implementing 21st Century Skills Competence in Vocational Education Learning	International Journal of Evaluation and Research in Education	Institute of Advanced Engineering and Science	67	[29]
5.	Digital Curation as a Core Competency in Current Learning and Literacy: A Higher Education Perspective	International Review of Research in Open and Distributed Learning	-	44	[30]
6.	Digital Literacies in Higher Education: Skills, Uses, Opportunities and Obstacles to Digital Transformation	Revista de Educación a Distancia	Universidad de Murcia	44	[5]
7.	A Learning Process Model to Enhance Digital Literacy Using Critical Inquiry through Digital Storytelling (CIDST)	International Journal of Emerging Technologies in Learning	Kassel University Press GmbH	38	[31]
8.	Collaborative Construction of a Project as a Methodology for Acquiring Digital Competences	Comunicar	Grupo Comunicar Ediciones	36	[32]
9.	Tools for Assessing Teacher Digital Literacy: A Review	Journal of Computers in Education	Springer Science and Business Media Deutschland GmbH	35	[33]
10.	Moving beyond the Tools: Pre-Service Teachers' Views on What They Value in a Digital Literacy Short Course	South African Journal of Education	South African Journal of Education	35	[34]

Overall, these articles with the highest number of citations reflect key issues in digital literacy, such as digital skills development, technology integration in teaching, challenges of the COVID-19 pandemic, and learning innovation. The significant number of citations indicates the relevance and impact of these articles in shaping academic discussions and educational practices related to digital literacy.

G. Digital Literacy in Classroom Teachings

Beyond the bibliometric trends, this review also aimed to identify strategies and challenges in improving digital literacy within classroom teaching. Based on the synthesis of the selected studies, several recurring themes were identified, namely the integration of technology, teacher training and development, equity and access, adaptability of teaching frameworks, and collaborative or blended learning approaches. These themes are elaborated to ensure that the discussion aligns directly with the research objectives and provides a comprehensive understanding of digital literacy in classroom contexts. From a specific search of the articles used, the following digital literacy strategies in teaching were obtained as Table 3.

Table 3. Digital Literacy Strategies in Classroom Teaching

No.	Strategy	Main Theme	Reference Number
1.	Leveraging AI and ML for personalized learning	Technology Integration	[35], [36], [37]
2.	Using mobile technology to increase accessibility and engagement		[38], [39]
3.	Professional development for teacher educators to integrate digital tools	Teacher Training and Development	[40], [41], [42]
4.	Local training to improve digital competency among teachers		[43]
	Addressing the digital divide by focusing on equitable access to resources	Equity and Access	
5.	Developing a framework for adapting teaching practices to changing technologies	Framework and Adaptability	[26], [33], [44]
6.	Encouraging collaboration between students and teachers through digital platforms	Collaborative and Blended Learning	[40]

Based on insights from various studies, several key strategies can be applied to integrate digital literacy into classroom teaching. Research by Zammit et al. [35] shows that artificial intelligence (AI) and machine learning (ML) can be used to create personalized learning. AI can analyze student data to provide recommendations for learning materials that are tailored to individual needs. For example, students with particular weaknesses in mathematics can be given special modules based on an analysis of their learning outcomes. One of the main benefits of AI and ML in education is their ability to create personalized learning experiences. This technology analyzes student data, such as exam results, interaction patterns, and learning activities, to understand the unique needs of each individual.

Based on this analysis, AI can recommend appropriate learning materials, such as videos, additional quizzes, or exercises that focus on student weaknesses [7]. Bruckhaus et al. [37] cite examples of platforms such as Khan Academy and Duolingo that have utilized AI to adjust the difficulty level of the material based on the student's abilities. With this approach, students not only learn more effectively but also understand how technology supports their learning

process. This approach improves students' digital literacy, as they learn to use technology to solve problems and access relevant resources. AI and ML also play a role in lightening the administrative burden on teachers, allowing them to focus more on teaching. This technology can be used to automate assignments, such as correcting multiple-choice exams or even grading essays using natural language processing algorithms.

In addition, AI provides an analysis of overall class performance, helping teachers identify students who need more attention [35]. With this automation, teachers not only save time but also develop their digital skills through the use of advanced technology. This automation supports teachers' digital literacy by familiarizing them with working with digital tools in their daily activities [45]. AI and ML are also used to directly improve students' digital literacy through various tools and applications. One of them is AI-based educational chatbots, which can answer students' questions related to learning materials or provide guidance on using digital platforms [7]. In addition, AI-based simulations allow students to practice real-world skills, such as virtual laboratory experiments or data-driven decision-making. For example, applications such as Google Socratic use AI to provide step-by-step explanations of math or science problems, while AI-based virtual labs allow students to conduct experiments without the need for a physical laboratory. Through these tools, students not only learn how to use technology but also develop critical and ethical thinking skills in utilizing digital technology [7].

On the other hand, Mullen's research [38] emphasizes the importance of mobile technology, such as smartphones and tablets, in increasing the accessibility of learning. This technology allows students to learn anywhere and anytime, eliminating geographical or time constraints. According to Thorell et al. [39], educational smartphone applications can also increase student engagement through interesting game-based interactions or quizzes. Teachers' ability to utilize technology is a determining factor in the success of digital literacy in the classroom. Paskevicius [40] highlights the importance of professional development for educators, especially those tasked with educating prospective teachers. Villalustre-Martínez [41] states that teacher training aims to improve teachers' skills in using digital devices, designing technology-based learning materials, and managing classes digitally.

A concrete example is a workshop on the use of Learning Management Systems (LMS) such as Google Classroom or Moodle. More specifically, in the findings of Fauzan [12], locally based training can help teachers understand technology in the context of local culture and resources. This is especially important in areas with limited access to technology, where training must be adapted to local conditions such as minimal technological infrastructure. Digital literacy in the classroom must consider equality of access so that no student is left behind. According to Fauzan [12], this is important because of the digital divide by ensuring that all students have

fair access to technological devices and the internet. This strategy includes providing loan devices (laptops/tablets) in schools, subsidizing internet access for low-income families, and providing digital learning spaces in community environments.

Paskevicius [40] added that collaboration and a combination of traditional and digital learning methods can be an option. Blended learning combines face-to-face sessions with online activities. This model provides students with the flexibility to access digital learning materials at any time while utilizing face-to-face time for in-depth discussions or practical activities. This strategy is very effective in providing a holistic and interactive learning experience. Technological change requires an adaptive framework for teaching. Nguyen and Habók [33] recommend developing a framework that helps teachers adapt their teaching methods according to new technologies so that they have clear guidance regarding the vision of technology in schools. The framework should also include the development of students' digital literacy skills, such as searching critically for information, evaluating sources, and using digital media ethically [26]. Teachers need to guide students not only to use technology but also to understand its impact on their learning [44].

Overall, the findings indicate that digital literacy in classroom teaching is multi-dimensional, requiring integration of technology, continuous teacher development, equitable access, adaptable frameworks, and collaborative learning approaches. These themes directly align with the research objectives by revealing both effective strategies and persistent challenges. The synthesis underscores that advancing digital literacy demands not only technological solutions but also systemic and inclusive educational practices.

Conclusion

The study found 91 publications related to digital literacy in teaching. The research trend shows a significant increase from year to year. This indicates the increasing attention and urgency of this topic among researchers. A total of 42 countries were identified as the origin of publications, with Indonesia as the country of origin of the most publications. In addition, the main themes werend to be related to potential strategies for digital literacy in teaching, ranging from the use of advanced technology to empowering teachers and students. These strategies aim to create an inclusive, adaptive, and collaborative learning environment where technology becomes a tool to support meaningful learning. By ensuring effective technology integration, adequate teacher training, equity of access, and the use of collaborative teaching methods, digital literacy can be the main foundation for the success of education in the digital era.

Limitation and Suggestions

This study is limited in several ways. First, the review was conducted using only the Scopus database, which may have excluded relevant studies indexed in other databases such as Web of Science or ERIC. Second, the inclusion criteria restricted the analysis to open access articles published in English, which may have resulted in the omission of important works in other languages or closed-access journals. Third, while the systematic review identified key themes and strategies, the synthesis was primarily descriptive and did not include meta-analysis of effect sizes or empirical measurements of digital literacy outcomes. Future studies are therefore encouraged to expand the scope by incorporating multiple databases, broader language coverage, and more diverse publication types. Comparative analyses across countries or educational levels could also offer more details about contextual differences in digital literacy implementation. In addition, future research could employ mixed-method approaches or meta-analyses to evaluate the effectiveness of specific strategies, thus offering stronger evidence to guide policy and practice in promoting digital literacy in classroom teaching.

Acknowledgment

The process of writing this article was not without challenges, but thanks to the support of many parties, we were able to complete it as planned. We express our deepest appreciation to all parties who have made valuable contributions to the process of writing this article. Our special thanks go to our academic colleagues and colleagues, institutions and universities, as well as family and friends. Hopefully this article can make a meaningful contribution to the development of digital literacy in classroom teaching and become a useful reference for educators, researchers, and education practitioners. We realize that this article is far from perfect, so we really hope for constructive criticism and suggestions from readers for future improvements. Finally, we express our deepest gratitude for all the help and support that has been given by all parties. Hopefully this article can be one small step in supporting the progress of the world of education in the digital era.

Conflict of Interest

We declare there is no conflict of interest.

References

[1] A. Cosby, E. S. Fogarty, and J. Manning, "Digital literacy and digital self-efficacy of australian technology teachers," *Educ. Sci.*, vol. 13, no. 5, p. 530, May 2023, doi: 10.3390/educsci13050530

[2] E. F. Rusydiyah, E. Purwati, and A. Prabowo, "How to use digital literacy as a learning resource for teacher candidates in indonesia," *J. Cakrawala Pendidik.*, vol. 39, no. 2, pp. 305–318, Jun. 2020, doi: 10.21831/cp.v39i2.30551.

[3] Q. Zheng, Z. Yuan, and X. Pan, "Examining the influencing effect of EFL students' digital literacy on their online learning power: the mediating role of perceived teacher support," *Asia Pacific J. Educ.*, vol. 45, no. 1, pp. 20–34, Jan. 2025, doi: 10.1080/02188791.2024.2404669.

[4] V. A. Samane-Cutipa, na M. Quispe-Quispe, F. Talavera-Mendoza, and C. H. Limaymanta, "Digital gaps influencing the online learning of rural students in secondary education: a systematic review," *Int. J. Inf. Educ. Technol.*, vol. 12, no. 7, pp. 685–690, 2022, doi: 10.18178/ijiet.2022.12.7.1671.
[5] A. Monteiro and C. Leite, "Digital literacies in higher education," *Rev. Educ. a Distancia*, vol. 21, no. 65, Jan. 2021, doi: 10.6018/red.438721.
[6] D. Szabó, K. Győri, P. Lajos, and G. Pusztai, "Systematic literature review on parental involvement in digital education," *J. Media Lit. Educ.*, vol. 16, no. 2, pp. 98–107, Jul. 2024, doi: 10.23860/JMLE-2024-16-2-8.
[7] S. M. Bender, "Awareness of artificial intelligence as an essential digital literacy: chatgpt and gen-ai in the classroom," *Chang. English*, vol. 31, no. 2, pp. 161–174, Apr. 2024, doi: 10.1080/1358684X.2024.2309995.
[8] S. McGrew and J. Breakstone, "Civic online reasoning across the curriculum: developing and testing the efficacy of digital literacy lessons," *AERA Open*, vol. 9, Jan. 2023, doi: 10.1177/23328584231176451.
[9] G. A. Nikitina, "Complex competency-based model of the intending foreign language teacher," *Perspect. Sci. Educ.*, vol. 53, no. 5, pp. 223–237, Nov. 2021, doi: 10.32744/pse.2021.5.15.
[10] M. Petrovic-Dzerdz and A. Trépanier, "Online hunting, gathering and sharing – a return to experiential learning in a digital age," *Int. Rev. Res. Open Distrib. Learn.*, vol. 19, no. 2, May 2018, doi: 10.19173/irrodl.v19i2.3732.
[11] U. Rahmi, A. Azrul, and R. D. Mahande, "The prototype of blended learning's support system to improve the pre-service teacher's digital literacy," *J. Educ. Online*, vol. 19, no. 3, Sep. 2022, doi: 10.9743/JEO.2022.19.3.5.
[12] F. Fauzan, F. Arifin, M. A. Lubis, and F. M. Firdaus, "Lecturer's digital literacy ability in the pandemic," *Cypriot J. Educ. Sci.*, vol. 17, no. 4, pp. 1130–1142, Apr. 2022, doi: 10.18844/cjes.v17i4.7122.
[13] S. Capecchi *et al.*, "A gamified platform to support educational activities about fake news in social media," *IEEE Trans. Learn. Technol.*, vol. 17, pp. 1765–1779, 2024, doi: 10.1109/TLT.2024.3410088.
[14] C. W. Y. Lee, S. K. W. Chu, J. O. Y. Cheng, and R. Reynolds, "Plagiarism-free inquiry project-based learning with UPCC pedagogy," *Proc. Assoc. Inf. Sci. Technol.*, vol. 53, no. 1, pp. 1–11, Jan. 2016, doi: 10.1002/pra2.2016.14505301033.
[15] G. Walton, A. J. Pickard, and L. Dodd, "Information discernment, mis-information and pro-active scepticism," *J. Librariansh. Inf. Sci.*, vol. 50, no. 3, pp. 296–309, Sep. 2018, doi: 10.1177/0961000618769980.
[16] J. Mattar, C. C. Santos, and L. M. Cuque, "Analysis and comparison of international digital competence frameworks for education," *Educ. Sci.*, vol. 12, no. 12, p. 932, Dec. 2022, doi: 10.3390/educsci12120932.
[17] A. Suvandy, P. Chatwattana, and P. Nilsook, "The micro-learning activities via metaverse platform: the outcomes of students' at pakse teacher training college, Lao PDR," *TEM J.*, pp. 1675–1683, May 2024, doi: 10.18421/TEM132-80.
[18] L. M. Ungerer, "Digital curation as a core competency in current learning and literacy: a higher education perspective," *Int. Rev. Res. Open Distrib. Learn.*, vol. 17, no. 5, Sep. 2016, doi: 10.19173/irrodl.v17i5.2566.
[19] R. Tirado-Morueta, R. García-Ruíz, Á. Hernando-Gómez, P. Contreras-Pulido, and J. I. Aguaded-Gómez, "The role of teacher support in the acquisition of digital skills associated with technology-based learning activities: the moderation of the educational level," *Res. Pract. Technol. Enhanc. Learn.*, vol. 18, p. 010, Oct. 2022, doi: 10.58459/rptel.2023.18010.
[20] H.-P. Hsu, Z. Wenting, and J. E. Hughes, "Developing elementary students' digital literacy through augmented reality creation: insights from a longitudinal analysis of questionnaires, interviews, and projects," *J. Educ. Comput. Res.*, vol. 57, no. 6, pp. 1400–1435, Oct. 2019, doi: 10.1177/0735633118794515.
[21] S. Soeprijanto, A. Diamah, and R. Rusmono, "The effect of digital literacy, self-awareness, and career planning on engineering and vocational teacher education students' learning achievement," *J. Technol. Sci. Educ.*, vol. 12, no. 1, p. 172, Mar. 2022, doi: 10.3926/jotse.1434.
[22] D. Gough and M. Richardson, "Systematic Reviews," in *Advanced Research Methods for Applied Psychology*, London: Routledge, 2024, pp. 71–86. doi: 10.4324/9781003362715-8.
[23] A. Y. Shestakova, D. O. Korolev, A. A. Afanasyev, I. V. Nikiforov, and O. A. Yusupova, "Scopus publications database analysis using its API," in *2nd International Conference on Computer*

Applications for Management and Sustainable Development of Production and Industry (CMSD-II-2022), A. Gibadullin and S. Sadullozoda, Eds., SPIE, Jan. 2023, p. 14. doi: 10.1117/12.2669237.
[24] Siska Merrydian, Indah Mustika Rini, Wardani Rahayu, and Riyadi, "Systematic Literature Review: Internal and External Validity in Experimental Design," *EduInovasi J. Basic Educ. Stud.*, vol. 4, no. 3, pp. 987–1001, Sep. 2024, doi: 10.47467/edu.v4i3.2734.
[25] R. Brignardello-Petersen, N. Santesso, and G. H. Guyatt, "Systematic reviews of the literature: an introduction to current methods," *Am. J. Epidemiol.*, Jul. 2024, doi: 10.1093/aje/kwae232.
[26] G. Falloon, "From digital literacy to digital competence: the teacher digital competency (TDC) framework," *Educ. Technol. Res. Dev.*, vol. 68, no. 5, pp. 2449–2472, 2020, doi: 10.1007/s11423-020-09767-4.
[27] S. Tejedor, L. Cervi, A. Pérez-Escoda, and F. T. Jumbo, "Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador," *Publications*, vol. 8, no. 4, pp. 1–17, 2020, doi: 10.3390/publications8040048.
[28] K. van de Oudeweetering and J. Voogt, "Teachers' conceptualization and enactment of twenty-first century competences: exploring dimensions for new curricula," *Curric. J.*, vol. 29, no. 1, pp. 116–133, 2018, doi: 10.1080/09585176.2017.1369136.
[29] F. Mutohhari, S. Sutiman, M. Nurtanto, N. Kholifah, and A. Samsudin, "Difficulties in implementing 21st century skills competence in vocational education learning," *Int. J. Eval. Res. Educ.*, vol. 10, no. 4, pp. 1229–1236, 2021, doi: 10.11591/ijere.v10i4.22028.
[30] L. M. Ungerer, "Digital curation as a core competency in current learning and literacy: A higher education perspective," *Int. Rev. Res. Open Distrib. Learn.*, vol. 17, no. 5, pp. 25–27, 2016, doi: 10.19173/irrodl.v17i5.2566.
[31] S. Kaeophanuek, J. Na-Songkhla, and P. Nilsook, "A learning process model to enhance digital literacy using critical inquiry through digital storytelling (CIDST)," *Int. J. Emerg. Technol. Learn.*, vol. 14, no. 3, pp. 22–37, 2019, doi: 10.3991/ijet.v14i03.8326.
[32] M. Pérez-Mateo, M. Romero, and T. Romeu-Fontanillas, "Collaborative construction of a project as a methodology for acquiring digital competences," *Comunicar*, vol. 21, no. 42, pp. 15–23, 2014, doi: 10.3916/C42-2014-01.
[33] L. A. T. Nguyen and A. Habók, "Tools for assessing teacher digital literacy: a review," *J. Comput. Educ.*, vol. 11, no. 1, pp. 305–346, 2024, doi: 10.1007/s40692-022-00257-5.
[34] S. C. Strydom, H. Wessels, and C. Anley, "Moving beyond the tools: Pre-service teachers' views on what they value in a digital literacy short course," *South African J. Child. Educ.*, vol. 11, no. 1, 2021, doi: 10.4102/sajce.v11i1.929.
[35] M. Zammit, I. Voulgari, A. Liapis, and G. N. Yannakakis, "Learn to machine learn via games in the classroom," *Front. Educ.*, vol. 7, 2022, doi: 10.3389/feduc.2022.913530.
[36] S. M. Bender, "Awareness of artificial intelligence as an essential digital literacy: chatgpt and gen-ai in the classroom," *Chang. English Stud. Cult. Educ.*, vol. 31, no. 2, pp. 161–174, 2024, doi: 10.1080/1358684X.2024.2309995.
[37] A. A. Bruckhaus *et al.*, "Evaluation of students' digital literacy through an immersive university-high school collaboration," *Front. Educ.*, vol. 9, 2024, doi: 10.3389/feduc.2024.1429893.
[38] M. Mullen, "Broadening language learner perceptions of 'actual, proper study' to be more inclusive of smartphones in irish secondary schools: "for like actual like proper study, and schoolwork, i wouldn't use my phone at all really," *Teanga*, vol. 28, pp. 86–113, 2021, doi: 10.35903/teanga.v28i.686.
[39] M. Thorell, P. K. Fridorff-Jens, P. Lassen, T. Lange, and L. Kayser, "Transforming students into digital academics: A challenge at both the individual and the institutional level Approaches to teaching and learning," *BMC Med. Educ.*, vol. 15, no. 1, 2015, doi: 10.1186/s12909-015-0330-5.
[40] M. Paskevicius, "Empowering future educators: leveraging openness by design when integrating technology in teacher education programs," *Edutec*, vol. 84, pp. 103–120, 2023, doi: 10.21556/edutec.2023.85.2845.
[41] L. Villalustre-Martínez, "Gamification narratives and competency assessment in initial teacher training," *Ocnos*, vol. 23, no. 2, 2024, doi: 10.18239/ocnos_2024.23.2.431.
[42] A. Suvandy, P. Chatwattana, and P. Nilsook, "The Micro-learning activities via metaverse platform: the outcomes of students' at pakse teacher training college, Lao PDR," *TEM J.*, vol. 13, no. 2, pp. 1675–1683, 2024, doi: 10.18421/TEM132-80.
[43] F. Fauzan, F. Arifin, M. A. Lubis, and F. M. Firdaus, "Lecturer's digital literacy ability in the pandemic," *Cypriot J. Educ. Sci.*, vol. 17, no. 4, pp. 1130–1142, 2022, doi: 10.18844/cjes.v17i4.7122.
[44] J. Mattar, C. C. Santos, and L. M. Cuque, "Analysis and comparison of international digital

competence frameworks for education," *Educ. Sci.*, vol. 12, no. 12, 2022, doi: 10.3390/educsci12120932.

[45] G. Bekmanova, Y. Ongarbayev, B. Somzhurek, and N. Mukatayev, "Personalized training model for organizing blended and lifelong distance learning courses and its effectiveness in Higher Education," *J. Comput. High. Educ.*, vol. 33, no. 3, pp. 668–683, Dec. 2021, doi: 10.1007/s12528-021-09282-2.

Authors

Elsa Viona is a doctoral program student in education, FKIP, University of Bengkulu, Indonesia. Her research interests are in educational management, educational administration, educational science, and social science. She actively writes articles on education and contributes to book chapters on educational management and policy analysis. (email: elsavionaona29@gmail.com).

Sudarwan Danim is a Professor of Education in Bengkulu University. He currently serves as Head of the Doctoral Study Program in Education, FKIP, University of Bengkulu. His research fields are leadership, supervision, educational management, educational administration, and educational science. He has appeared as a speaker both nationally and internationally. He actively writes articles and books. (email: sudarwan@unib.ac.id).

Rosane Medriati is a senior lecturer in education at the University of Bengkulu. She currently serves as a lecturer in the Physics Education Study Program, FKIP, University of Bengkulu. Her research areas are physics education, curriculum, educational management, educational administration, and educational science. She has appeared as a speaker at many national seminars. She is also active as a professional trainer. She actively writes articles and books. (email: rosanemedriati@yahoo.com).

Muhammad Kristiawan is is an Associate Professor of Education in University of Bengkulu. Currently he serves as lecturer in Master of Educational Administration Study Program of University of Bengkulu. His research area is about leadership, supervision, management and administration of education, science of education, social science and technology. He has ever performed as international speakers in many international conferences both India, Philippines, Thailand, Malaysia, Vietnam, and Indonesia. He has reviewed a lot of articles from reputable international journal which published by Sage, Frontiers, Springer Nature, Taylor & Francis, Humanities & Social Sciences Communications, Npj Climate Action, Intelektual Pustaka Media Utama, Journal of Learning for Development and others. (email: muhammadkristiawan@unib.ac.id).

Edy Susanto is a residence in Sawah Lebar, Ratu Agung District, Bengkulu City, Bengkulu Province. His educational history, Undergraduate Degree of Mathematics Education at University of Muhammadiyah Bengkulu; Master Graduate of Educational Administration at University of Bengkulu and Doctoral Education at University of Bengkulu. He is actively writing books on education. (email: edy.susanto722@gmail.com).

Sheren Dwi Oktaria is a writer and lecturer at Lampung University. Furthermore, she leads the Education Quality Assurance Team for the Masters of Educational Technology Program. She is involved in national-level educational, social, and economic organizations, as well as various training activities and interactive learning media development. She also actively writes and publishes scientific articles in national and international journals. Her scientific fields of study include Blended Learning, Learning Management System (LMS), learning media, and innovative learning models. (email: sheren.dwi@fkip.unila.ac.id).

Julie Simon Macariola is a licensed professional educator with extensive experience in academia since 2003. She holds a Bachelor of Secondary Education (BSED) degree in Filipino Language, as well as a Master's degree in Education (MAEd) with a specialization in Guidance and Counseling. Currently, she is pursuing a Doctorate in Philosophy (PhD) with a major in English. She serves as the International Affairs Manager at Shinawatra University. She is also the International Ambassador for GLEARS Philippines and holds the position of Chief Deputy Director at PSHE Inc. (e-mail is: julie.s@siu.ac.th).