



Digital Literacy Dan Cyber Socialization In The Context Of 21st Century Education: A Systematic Review

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ABSTRACT

This research provides an in-depth review of the integration of digital literacy and cyber socialization in 21st-century education, positing the importance of these two aspects in preparing students for an ever-evolving world. Using PRISMA's framework for systematic analysis, the study evaluated articles from reputable journals between 2014 and 2024, presenting results that underscore a significant shift in the educational paradigm from traditional to digital. Digital literacy, defined as the ability to use technology efficiently, search and evaluate information, and communicate effectively on digital platforms, has become an essential requirement in modern education. The study shows that digital literacy not only improves technical skills but also supports critical and creative learning among students. In addition, digital literacy education includes teaching ethics and online safety and encouraging responsible internet use. Cyber socialization, with its focus on interaction through social media and digital platforms, has enriched the learning experience through wider collaboration and exchange of resources. However, it also poses challenges such as cyberbullying and security issues, which demand a structured educational response to address related social and psychological issues. The Industrial Revolution 4.0 and the COVID-19 pandemic have accelerated the acceptance of technology in education, emphasizing the importance of character education and the adaptation of innovative teaching methods. Education that is responsive to technological change must integrate digital literacy into all aspects of learning, leading to a more holistic and inclusive approach. Overall, the study underscores the importance of digital literacy and cyber socialization in shaping adaptive and supportive learning environments. 21st-century education must recognize and utilize technology not only as an auxiliary tool but as an integral part of the curriculum, to equip students with the skills needed to succeed in the digital age. By ensuring that digital literacy and cyber socialization are at the heart of education, we can anticipate future needs and challenges, shaping a generation that can not only survive but thrive in an ever-changing digital landscape.

Keywords: Digital Literacy; Cyber Socialization; 21st-Century Education

INTRODUCTION

In the era of globalization and rapid technological advancement, education is undergoing a significant transformation with the shift of traditional paradigms towards a more digital approach. In this context, digital literacy and cyber socialization are essential components of

21st-century education, responding to the evolving need for adaptation to digital platforms. Digital literacy is not just about the ability to use digital tools and technologies but also includes the skills and competencies to identify digital resources, manage content, evaluate information critically, and analytically, and

communicate effectively with others (Chan *et al.*, 2017; Ozdamar-Keskin *et al.*, 2015; Tejedor *et al.*, 2020). This multidisciplinary dimension of digital literacy includes knowledge, skills, attitudes, and cognitive aspects, all of which are essential in higher education (Gang & He, 2022).

The importance of digital literacy in education is underscored by its role in increasing students' capacity to adapt to technological advances, use technology efficiently, and develop interactive learning materials (Anggraeni, 2023; Ozdamar-Keskin *et al.*, 2015). More so, digital literacy is fundamental to lifelong learning, enabling individuals to search for information effectively, evaluate information critically, and identify biases in information sources (Reid *et al.*, 2023). As education continues to digitize, digital literacy skills are becoming increasingly important for successful learning experiences (Abiddin *et al.*, 2022).

The COVID-19 pandemic has highlighted the importance of integrating digital literacy into educational practices more than ever, accelerating the transition to online learning and demanding rapid adaptation from educational institutions, teachers, and students (Purnama *et al.*, 2021). The COVID-19 pandemic has further emphasized the importance of digital literacy, with concerns emerging about learning efficacy, cyber threats, and the need for increased socialization in online learning environments (Wei, 2022). The development of digital literacy skills is closely related to ethical considerations in using digital technology, emphasizing the responsible and ethical use of digital media and the Internet (Sari, 2018). In addition, digital literacy plays a crucial role in accessing high-quality learning resources and improving students' cognitive abilities (Marisa & Djulia, 2022).

In realizing an educational environment that is adaptive and responsive to present and future needs, educational

institutions need to integrate digital literacy and cyber socialization into the educational framework. Cyber socialization is essential to promote safe and responsible online behaviour among students, especially in the use of social media and digital technologies (Rice *et al.*, 2016). Educational interventions that focus on areas such as cyberbullying and cyber ethics are essential to safeguard student well-being in a digital environment (Aisyah *et al.*, 2020). A collaborative effort between educators and parents is essential to monitor students' online activities, including social media use and cyber victimization, to support their adjustment and mental health during virtual learning experiences (Wang, 2024). It is not only about enriching students' learning experience but also preparing them for success in an increasingly digital world. Digital literacy is a foundational skill in modern education, essential for exploring the digital landscape, fostering critical thinking, and facilitating effective communication.

The integration of digital literacy and cyber socialization in education is an imperative act to equip students with the necessary skills to thrive in the digital age. By cultivating critical thinking, responsible online behaviour, and effective digital communication, educational institutions can better prepare students to navigate challenges and take advantage of the opportunities presented by the digital age. This readiness is not only important for students' academic success but also for their readiness to face an increasingly digitalized world of work, where digital skills and adaptability are becoming more valuable than ever. Ensuring that education remains relevant in the face of technological change means accepting that digital literacy and cyber socialization must be placed at the heart of the curriculum, not just as an adjunct or afterthought. Thus, the education of the future can truly align itself with the needs and challenges of the 21st century,

creating the next generation that not only survives but thrives in an ever-changing digital landscape.

Therefore, as education evolves to meet the challenges and opportunities of the digital age, it is important to recognize cyberdigital and social literacy as key to preparing students for this changing world. Education must adapt, not just in the technology used but also in teaching and learning methods, to ensure that students are not only able to survive but thrive in the 21st century. Recognizing this, future education must be inclusive, adaptive, and continuously innovative to integrate digital literacy in all aspects of learning, making students not only efficient users of technology but also critical thinkers and ethical lifelong learners. The objectives of this study are 1) outline the evolution of digital education; 2) elaborate digital literacy in Education; 3) describe social cyber in education; and 4) outline the role of technology in improving digital literacy.

METHOD

This research uses the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analyses) framework to conduct a systematic review and meta-analysis of articles related to digital literacy, cyber socialization, and case studies from reputable international

journals indexed in Scopus. The PRISMA framework is a widely recognized tool for evaluating systematic reviews and meta-analyses consisting of 4 steps: 1) (Released *et al.*, 2009; Moher *et al.*, 2009) Identification of journals to be included in the meta-analysis; 2) Screening, screening or selection of data; 3) Eligibility, determining the article to be used as material for literature assessment; and 4) Inclusion, combining and reporting results. Article selection is limited to the last 10 years (2014-2024) and is carried out using databases such as Science Direct and Google Scholar, with specific search keywords related to the topic of study.

This research focuses on articles from reputable international journals with the Scopus Q1-Q4 index, which shows a rigorous selection process based on the quality and impact of the journal. This approach helps ensure that the data and findings drawn from selected articles come from credible and reliable sources, thereby increasing the validity and strength of the research as a whole.

The following are the results of an illustrative analysis from PRISMA (Preferred Reporting Items for Systematic Reviews And Meta-Analyses) based on articles relevant to the research study can be seen in Figure 1 below.

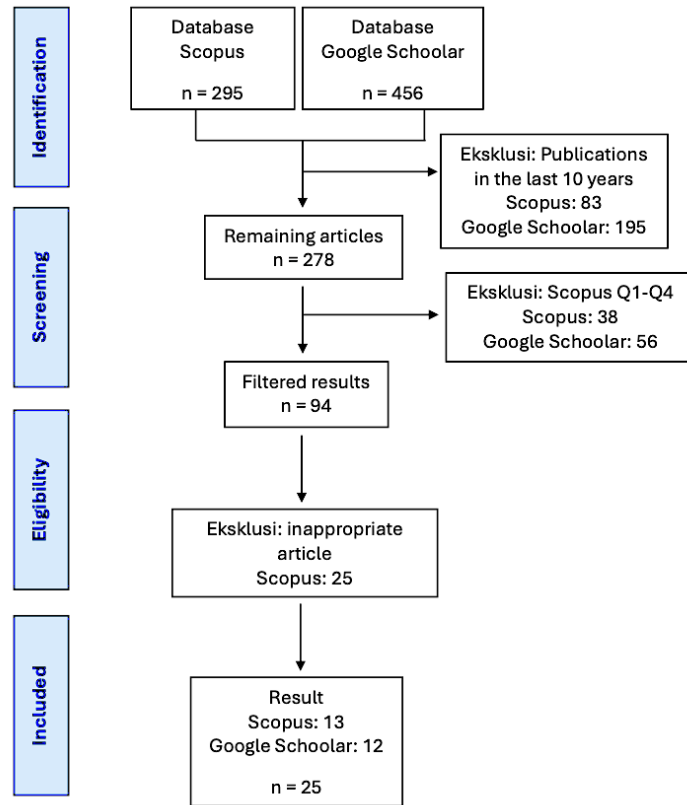


Figure 1. Flowchart Illustrates the Mapping of the Selection of Relevant Articles For Systematic Review (Adaptation From Zarate *et al.*, 2022)

Table 1. Article Selection Results

No.	National Of Context	Reviewed Studies	Name Of Journal	Index Scopus
1	Peru	Clemente <i>et al.</i> , 2024	International Journal of Engineering Pedagogy	Q2
2	Peru	Villanueva <i>et al.</i> , 2024	International Journal of Engineering Pedagogy	Q2
3	Jordan	Alsahlil <i>et al.</i> , 2024	International Journal of Engineering Pedagogy	Q2
4	Patras, Greece	Dimitris <i>et al.</i> , 2023	International Journal of Computer Integrated Manufacturing	Q2
5	Iraq	Dujaili <i>et al.</i> , 2024	International Journal of Engineering Pedagogy	Q2
6	California	Fusun <i>et al.</i> , 2017	Journal of Statistics Education	Q2
7	Hong Kong	Antti <i>et al.</i> , 2023	Cogent Engineering	Q2
8	Cina	Chi-Un <i>et al.</i> , 2013	Procedia Computer Science	Q3
9	Kazakhstan	Bayan <i>et al.</i> , 2024	International Journal of Engineering Pedagogy	Q2

No.	National Of Context	Reviewed Studies	Name Of Journal	Index Scopus
10	Scotland	Konstantina et al., 2023	Computer in the school	Q2
11	Australia	Christopher et al., 2020	Higher Education Pedagogies	Q2
12	Spain	Álvaro et al., 2024	Journal Internet of Things	Q1
13	Odisha	Chiranjibi et al., 2023	Asian Journal of Multidisciplinary Research & Review (AJMRR)	
14	Spain	Alicia et al., 2016	Procedia - Social and Behavioral Sciences	
15	Switzerland	Asmayawati et al., 2024	Journal of Open Innovation: Technology, Market, and Complexity	Q1
16	Malaysia	Chan et al., 2024	Asia Pacific Journal Of Education	Q2
17	China	Mingyue et al., 2023	Linguistics and Education	Q1
18	Thailand	Wawta et al., 2018	Kasetsart Journal of Social Sciences	Q3
19	New York	Amankwa et al., 2021	Journal of Information Security	Q1
20	Switzerland	Hatzivasilis, et al., 2020.	Applied Sciences	Q2
21	Indonesia	Rahmawati et al., 2023	Proceeding National Conference on Educational Science and Counselling	
22	United Kingdom	Johnson et al., 2019.	Higher Education Pedagogies	Q2
23	Spain	Sánchez, et al., 2020.	Sensors	Q1
24	India	Murty et al., 2019	Proceedings of International Conference on Digital Pedagogies (ICDP).	
25	Indonesia	Kodrat et al., 2020	Islamic Research	

RESULTS AND DISCUSSION

1. The Evolution of Digital Education

The shift from traditional classroom-based education to online learning in response to the COVID-19 pandemic. This shift represents an evolution in the way education is delivered and accessed by students, involves the use of technology as the primary medium of learning, provides greater flexibility and accessibility for students, and requires the integration of new learning methodologies appropriate to the digital environment. The evolution of digital education includes transformation in the way education is delivered, the use of technology, learning flexibility, and

adaptation to environmental changes such as the COVID-19 pandemic (Alsahhi et al., 2024).

After the COVID-19 pandemic, the evolution of digital education integrating information and communication technology (ICT) in education has brought significant changes to the way learning and teaching are carried out. Through the adoption of ICT, education is becoming more interactive and accessible, allowing students to gain access to a wider range of resources and teachers to transition from traditional roles to facilitators. While these benefits are clear, there are significant challenges to be addressed, including the need for adequate teacher training and

infrastructure upgrades. Therefore, the adoption of ICT in education not only provides opportunities but also requires careful planning and ongoing support to ensure that these technologies can be utilized effectively and efficiently in educational environments. Thus, a holistic and strategic approach to integrating ICT is essential to form an education system that is adaptive and responsive to the needs of the modern information society (Alrikabi *et al.*, 2024).

The evolution of digital education, accelerated by the Industrial Revolution 4.0 and the COVID-19 pandemic, has radically changed the face of education. Now, education is no longer limited to conventional face-to-face methods but has shifted to a hybrid model that integrates advanced technologies such as IoT, AI, and Digital Twins. This transformation enables a more personalized and responsive approach to learning, supporting educational flexibility and accessibility. Hybrid education, which combines online and face-to-face elements, reflects a shift towards a more student-focused approach, where they can access learning resources anytime and anywhere, leveraging technology to enrich their learning experience. This marks a new era in education, where digitalization is helping to overcome physical limitations and expand the reach of education globally (Mourtzis *et al.*, 2022), further in the evolution of digital education through the application of cloud computing in e-learning, highlights the important role of information and communication technology in education today. Education powered by cloud computing brings several significant advantages, such as easy access to learning resources from anywhere and anytime, which effectively increases the flexibility and scalability of the education system. Advances in information technology that have increased network bandwidth and data access speeds while lowering data storage

costs are also accelerating the adoption of this cloud-based approach. Another plus is the improvement of the quality of teaching and learning through flexible resources, which can be accessed by educators and learners. This reflects a shift towards next-generation information technology architectures that not only increase productivity but also reduce operational costs, in line with increased access to broader and more inclusive education (Al-Dujaili *et al.*, 2024).

Based on the evolution of digital education, it can be understood that the evolution of digital education accelerated by the COVID-19 pandemic and the Industrial Revolution 4.0 has brought radical changes in the way education is delivered and accessed. The move from traditional classroom models to online-based approaches has provided increased flexibility and accessibility for students, allowing them to access education from any location. The integration of Information and Communication Technology (ICT), including the application of IoT, AI, and Digital Twins, has created a hybrid model that is more personalized and responsive to individual needs. While there are many benefits of digital education, such as wider availability of resources and more flexible learning, challenges remain, including the need for more effective teacher training and improved supporting infrastructure. Emphasis is placed on a holistic and strategic approach to integrating ICT to ensure that the technology can be utilized efficiently. In addition, the adoption of cloud computing has increased the scalability and accessibility of education even further, while reducing operational costs and increasing productivity through more flexible and accessible resources. In this context, digital education has not only established an adaptive and inclusive system but also continues to adapt to the needs of the rapidly changing information society.

2. Digital Literacy in Education

In the context of education, digital literacy has gained significant attention. Such academics highlight the important role of digital literacy in reshaping learners' pedagogy, emphasizing the need for a critical approach to integrating digital literacy to improve teaching and learning practices (Goodfellow, 2011). Furthermore, Buckingham (2007) argues that digital literacy should be considered as part of a broader redefinition of literacy, emphasizing the importance of technological incorporation in educational settings

The COVID-19 pandemic has further emphasized the importance of digital literacy in education. Studies have Weaver *et al.*, (2020) and Endrayanto *et al.*, (2022) explored the development of digital literacy in a variety of contexts, including the impact of the pandemic on educational

practices. The transition to online learning during the pandemic has highlighted the essential nature of digital literacy skills for both educators and students

Alkalai identifies five types of abilities in digital literacy: 1) Photo-visual literacy, which is the ability to read and understand visual information; 2) Reproductive literacy, namely the ability to use digital technology in creating new works; 3) Branching literacy, i.e. the ability to navigate non-linear media in the digital space; 4) Information literacy, namely the ability to search for, find, assess, and critically evaluate information on the web; and 5) Socio-emotional literacy, which includes the social and emotional aspects of online interactions, be it through socialization, collaboration, or content consumption (Fitriani *et al.*, 2023).

The following are the results of the synthesis of review articles in digital literacy studies in Table 2 below.

Table 2. Article Synthesis in the Context of Digital Literacy in Education

No	Title	Synthesis
1	Maddie is Online': A Creative Learning Path to Digital Literacy for Young People	"Maddie is Online" highlights the need for innovative digital literacy education for young people, paying attention to their feelings towards online connectivity and the importance of being responsible participants in cyberspace. This holistic approach needs to integrate online security and digital ethics, leading to safer and more responsible use of the internet.
2	An Overview Of Digital Literacy And Cyber Socialization In The Educational Scenario Of 21st Century	Digital literacy refers to an individual's ability to access, understand, and use information and communication technology (ICT) effectively. Meanwhile, cyber socialization refers to interaction, communication, and relationship formation in online spaces. These two concepts are interrelated and have a profound impact on individuals, groups, and society as a whole.
3	Digital literacy and cyberconvivencia in primary education	The use of the Internet and mobile phones is quite similar at both stages. Furthermore, there is a need for specific literacy that teaches how to use the Internet safely and manage the relationships and interactions it causes. As such, this study makes an important contribution to our understanding of the importance of digital literacy and prevention efforts against cyberconvivencia-related negative behaviours, especially among children.

No	Title	Synthesis
4	Pedagogical innovation and curricular adaptation in enhancing digital literacy: A local wisdom approach for sustainable development in Indonesia context	The local wisdom approach acts as a mediator in the relationship between pedagogical innovation and digital literacy, as well as curriculum adaptation and digital literacy. In the context of Early Childhood Education, these findings suggest that the integration of local values and cultural wisdom has an important role to play in improving digital literacy and preparing students for a technology-enabled future.
5	Investigating university students' digital citizenship development through the lens of digital literacy practice: A Translingual and transemiotizing perspective	Students use a variety of linguistic and semiotic resources in their digital literacy practice to create complex digital identities. They use a variety of languages and semiotic systems to create meaning in communication on social media, as well as combine digital skills with academic activities, professional development, and social networking.
6	Development of digital literacy indicators for Thai undergraduate students using mixed-method research	Digital literacy criteria consist of four factors. The first factor is operating skills, which consist of cognition, innovation, and presentation. The second factor is thinking skills, consisting of analysis, evaluation, and creativity. The third factor is collaboration skills, consisting of teamwork, networking, and sharing. The fourth factor is awareness skills, consisting of ethics, legal literacy, and self-protection.
7	Digital Pedagogy—An Opportunity or a Threat?	Research highlights the benefits and challenges associated with the use of digital technology in an educational context. While digital technology can improve self-learning, cost efficiency, and flexibility, there are also challenges such as distance between learners and feedback, the potential for selecting learning materials without quality checking, and disruption in learning due to excessive edutainment. Although this study provides valuable insights, there are limitations such as limited data coverage, lack of field research, and absence of empirical data.

Based on the synthesis results in Table 2, it can be concluded that digital literacy is a key component in modern education and should be approached comprehensively and reflectively. The integration of technology, education, and cultural values is crucial to equipping individuals with the ability to succeed in this increasingly digital world. Effective digital literacy education should emphasize safety, ethics, and responsibility in the use of technology, as well as support the formation of a conscious and critical digital identity.

Views from research by Ozdamar-Keskin *et al.*, (2015) and Pangrazio *et al.*, (2020) exploring the various sub-disciplines of digital literacy, highlight the

multifaceted nature of digital competencies required in educational technology. The integration of digital literacy in education is not only about adopting new digital tools or learning technologies but also about developing an in-depth understanding of how these technologies can be used to enrich learning experiences. It involves learning how to search, evaluate, and use information effectively in a digital environment, as well as understanding ethics and security issues associated with the use of technology.

The development of digital literacy is associated with increased creativity and critical thinking among students (Reddy *et al.*, 2020; Sangaji & Pribadi, 2023). Research shows that digital literacy plays an

important role in improving the quality of education and student outcomes (Akil & Adnan, 2022; Perona *et al.*, 2015). It is proposed that digital literacy can catalyze 21st-century education, facilitating the development of new digital competencies essential for educational settings (Perona *et al.*, 2015). In addition, studies have explored the impact of digital literacy on specific subjects such as science education, emphasizing the role of digital media in improving scientific literacy among students (Tabieh *et al.*, 2021), digital literacy can evaluate the digital literacy competencies of teachers and principals in educational settings. Digital literacy skills by teachers are considered essential for effectively integrating technology into teaching practices and improving overall educational outcomes (Anggraeni, 2023; Mujiyanto & Suherman, 2021).

Thus, digital literacy in education serves as a foundation for students to navigate and thrive in today's and tomorrow's information society. Through an integrated and critical approach to digital literacy, educational institutions can improve the quality of learning and equip students with the skills they need to succeed in this ever-changing digital era.

3. Social Cyber in Education

In education, cybersocial has become an increasingly important phenomenon, where individuals engage in social interaction, communication, and collaboration through digital platforms such as social media and online communities. The significantly positive impact of social cyber is a collaborative learning experience, opening up new avenues for interaction and exchange of resources between students and educators (Ansari & Khan, 2020). Digital tools and social media have been shown to facilitate this form of collaborative learning, allowing students and educators to share

resources and collaborate in unprecedented ways.

However, the integration of social media in education presents challenges such as cyberbullying and cyber victimization. Studies have shown the prevalence of cyberbullying among students, with a significant percentage experiencing such incidents (Wang, 2024). Educational initiatives focused on combating cyberbullying and socializing safe use of social media are essential, especially for vulnerable groups such as indigenous youth (Rice *et al.*, 2016). In addition, studies have emphasized the mediating role of psychological problems and perceived social support about cyber victimization and negative outcomes such as suicidal behaviour (Sarhangi *et al.*, 2023).

Experts have proposed the integration of cyber principles into the curriculum to instil cyber ethics and responsible online behaviour among students (Ivy *et al.*, 2020). In addition, encouraging a positive school environment and implementing interventions such as anti-bullying programs can help reduce aggression and cyberaggression among students in social media settings (Mardianto *et al.*, 2020). Building a supportive atmosphere that fosters digital citizenship and ethical online behaviour is critical in reducing the negative impact of cyber socialization in educational contexts.

Based on the screening process carried out, 25 articles were obtained that were eligible for the topic of cyber pedagogy. Furthermore, from the 25 articles, 9 articles were identified that specifically discussed social cyber pedagogy. The synthesis results of the 9 articles in Table 3 are as follows.

Table 3. Article Synthesis in the Social Context of Cyber in Education

No.	Title	Synthesis
1.	T-CHAT educational framework for teaching cyber physical system engineering	The T-CHAT framework is used to teach cyber-physical systems engineering, emphasizing the integration of theory and practice by utilizing advanced technology to enhance student's learning experience in engineering.
2.	Developing a Smart Learning Environment in Universities Via Cyber-Physical Systems	This research discusses the use of Cyber-Physical Systems (CPSs) to build smart learning environments (SLEs) in universities. CPSs are used to collect information about the physical environment, convert measured data into information and knowledge, and provide useful and timely services for students, staff, and universities.
3.	Digital Twin Learning Ecosystem for Traditional Manufacturing SMEs: A Human-Machine Knowledge Integration Framework	This research aims to understand how the Digital Twin Learning Ecosystem concept facilitates the integration of human-machine knowledge in various contexts of traditional manufacturing SMEs. The research developed a framework consisting of three interconnected layers of digital twins, which enables the cyber-physical convergence of legacy production systems and skilled workers.
4.	An Overview Of Digital Literacy And Cyber Socialization In The Educational Scenario Of 21st Century	This article discusses the importance of digital literacy and cyber socialization in the context of education in the 21st century. Cyber socialization refers to interaction, communication, and relationship formation in online spaces. It also highlights the integration of digital literacy and cyber socialization in educational settings to improve academic performance, development of critical thinking skills, and preparation for future careers.
5.	A framework informing the interplay of physical, digital and social spaces in supporting an environment for active learning	This study aims to provide insights from both STEM and non-STEM perspectives on the interaction of physical, digital, and social spaces in support of active learning processes. The results suggest that physical space can influence information delivery and student engagement, while social space can strengthen relationships between students and lecturers.
6.	Relevance of cybersecurity education at pedagogy levels in schools.	Cybersecurity education in educational institutions has an important role to play in increasing individuals' awareness and knowledge of cyber risks and threats. Providing cyber security education to students from an early age is expected to protect them from various risks such as cyberbullying, online sexual crimes, and fraud.
7.	Modern aspects of cyber-security training and continuous adaptation of programmes to trainees	The research combines pedagogical practice with cyber security modelling to create an adaptive and dynamic cyber security training program. The training program is tailored to the needs of trainees and offers step-by-step assessments involving more advanced features as trainees gain understanding.
8.	Teacher Adaptation in the Digital Era: Addressing Challenges and	The study presents results showing that teachers tend to have a positive perception of the digital learning environment and the concept of Cyber Pedagogy. Nonetheless, teachers face several challenges in adopting educational technology, such as limited technological capabilities, difficulties in motivating students, and lack of technology

No.	Title	Synthesis
	Opportunities in Cyber Pedagogy	facilities. To overcome these obstacles, teachers collaborate with peers, learn from external sources to improve technological capabilities and use a personalized approach in designing teaching methods.
9.	An integral pedagogical strategy for teaching and learning IoT cybersecurity.	This research presents an integrated pedagogical strategy for teaching IoT security in higher education environments. The strategy includes continuous learning, from early to advanced, designed to ensure students acquire the technical knowledge and soft skills needed in IoT security.

Based on the synthesis of the 9 articles, cybersocial offers an avenue for collaborative learning and enriched educational experiences, essential for addressing issues in education such as cyberbullying and aggression. Educators play an important role in promoting positive online behaviour, offering support to students facing cyber victimization, and integrating cyber ethics into the curriculum to ensure a safe and conducive learning environment in the digital age. Through a holistic approach that addresses both the opportunities and challenges of cyber socialization, education can continue to evolve in a way that respects the integrity and well-being of all learners, encouraging them to become responsible and informed digital citizens.

4. The Role of Technology in Improving Digital Literacy

Based on a synthesis of 25 articles used in empirical studies that have gone through the stages of identification, screening, selection, and inclusion, it was found that the integration of technology in education plays a crucial role in improving digital literacy. The articles consistently emphasize the importance of digital literacy and how technology plays a role in strengthening individuals' ability to use information and communication technology effectively. Digital literacy encompasses a wide range of technological, cognitive, and socio-emotional skills essential for success in the digital age. With

a focus on the use of technology in both education and everyday life, these articles provide an in-depth understanding of how technology can be a powerful tool for improving digital literacy, enabling individuals to think, collaborate, and raise awareness in a digital environment, and preparing students for the demands of the ever-changing world of work by digital transformation.

Hague & Payton in their work "Digital Literacy across the Curriculum," define digital literacy as the capacity of an individual to use his or her functional skills on digital devices. This allows individuals to access and select information faster and more efficiently, hone critical thinking skills and enhance creativity. In addition, digital literacy facilitates cooperation with others, increases effectiveness and efficiency in communication, and strengthens security both in terms of technology and in social and cultural contexts. (Haya, 2023; Safitri, 2020)

Brian Wright mentions in an infographic titled "Top 10 Benefits of Digital Literacy: Why You Should Care About Technology" that digital literacy offers ten key benefits: 1) More efficient learning, 2) Financial savings, 3) Increased security, 4) Access to up-to-date information, 5) Constant connectivity, 6) More informed decision making, 7) Increased employment opportunities, 8) Increased happiness, 9) The ability to influence the world, and 10) Time efficiency. Digital literacy is one of the key

skills of the 21st century that includes learning and innovation, critical thinking, and communication and collaboration skills (Safitri, 2020).

In the modern era of education, digital literacy is not only a necessity but has developed into one of the main keys in the effective learning process. Recent research shows that the use of technology, educational applications, as well as learning management systems play a significant role in improving digital literacy, which in turn supports the creation of rich and interactive learning experiences (Faridah *et al.*, 2022; Hendriyani, 2022). The role of technology is increasingly critical, especially in facing challenges and rapid changes in today's educational environment

The application of online learning applications, for example, can positively influence students' learning interests (Awalia *et al.*, 2021). Furthermore, the development of audio-visual learning media can help in formulating teaching materials into a format that is more attractive and easily digested by students (Afifulloh & Sulistiono, 2023). Especially in elementary schools, the use of video media has been found to increase children's understanding and motivation for learning (Mubaidilla, 2023), showing the importance of adapting teaching methods to the times.

During the COVID-19 pandemic, digital literacy has become even more important, marked by the spread of misinformation through platforms such as Instagram, underscoring the urgency to strengthen digital literacy (Harahap *et al.*, 2023). The blended learning model, which combines offline and online methods, is emerging as a valuable approach post-pandemic, with implementation in a variety of different cycles demonstrating adaptation and flexibility in education (Yamin, 2022).

Research into digital literacy and internet addiction to online learning and its

effect on student motivation highlights the importance of these factors in educational settings (Reddy *et al.*, 2020b; Wei, 2022; Winarno and Ashari, 2022). This confirms that understanding and addressing the challenges that arise along with the integration of technology into learning is essential to maximizing its benefits

Training programs for educators, focusing on digital literacy, have proven effective in improving teaching competence and meeting national education standards (Sobri *et al.*, 2022). Workshops aimed at improving digital competence for teachers are also very useful in preparing them for the challenges posed by Society 5.0 (Prasetiyo *et al.*, 2022). Apps like Quizizz in early childhood education can improve literacy and numeracy skills (Krisnasari *et al.*, 2022), underscoring the great potential of technology in supporting the early development of important abilities for children. The importance of digital literacy competencies in learning during the COVID-19 pandemic has been emphasized, underscoring the need for adaptation to the ever-changing educational landscape (Ningsih *et al.*, 2021). This suggests that more than ever, educators and students need to be equipped with the ability and knowledge to effectively manage and utilize technology in learning.

In conclusion, the integration of technology, applications, and digital literacy training in educational settings is vital to promoting an effective learning environment and enhancing digital literacy among students and educators. It's not just about the use of technology in education, but more broadly, about preparing future generations with the skills necessary to succeed in this increasingly digital society. Therefore, a holistic and adaptive approach to the development and implementation of educational technology must continue to be prioritized to maximize its benefits for the learning process.

CONCLUSION

Based on the description of the results and discussion, the following conclusions can be drawn:

1. **The Role of Digital Literacy in 21st-Century Education:** In the rapidly evolving digital era, digital literacy is becoming an essential skill in education. Not only does it involve the ability to use technology, but digital literacy also includes critical skills in evaluating and managing information. Research shows that the integration of digital literacy in the curriculum can enhance creativity, and critical thinking, and prepare students for an ever-changing world. It affirms the importance of education that is adaptive and responsive to technological needs as well as the development of students' analytical and evaluative abilities.
2. **Impact of Cyber Socialization in an Educational Environment:** Cyber socialization, which includes interaction through social media and digital platforms, offers opportunities for collaborative learning and diverse interactions. However, it also presents challenges such as cyberbullying and privacy concerns. Research urges the importance of integrating the principles of cyber ethics and responsible online behaviour into the curriculum, to support students in navigating safe and ethical digital environments, as well as developing mature digital citizenship.
3. **Improving Digital Literacy through Technology and Training:** The utilization of technology in education, such as online learning applications and interactive media, can significantly improve the digital literacy of students and teachers. Training programs and workshops for educators, which focus on developing digital literacy, strengthen their capacity to integrate technology into teaching. This demonstrates the urgent need for a

holistic approach in education that not only targets the use of technology but also prepares learners and educators with the digital skills necessary for the information age.

RECOMMENDATION

1. **Increasing Digital Literacy Integration:** To answer the challenges of education in the digital era, educational institutions need to prioritize the integration of digital literacy in their curriculum. This includes training teachers and students in the effective, critical, and ethical use of digital technology. Thus, students not only become passive users of technology but also become critical thinkers and active learners throughout life.
2. **Cyberbullying Education Programs:** Developing and implementing special education programs that address the issue of cyberbullying and safe online behaviour needs to be a focus. The program should be designed to teach students about digital ethics, and cyber awareness, and develop the ability to interact positively in a digital environment. The program is essential to creating a safe and supportive learning environment.
3. **Collaboration Between Stakeholders:** Increasing collaboration between teachers, parents, and other stakeholders in digital education is vital. This synergy will help in monitoring and directing the use of social media and digital platforms by students, thereby optimizing benefits and minimizing the risks associated with the use of technology. This collaboration is also important for rapid adaptation to evolving educational innovations.

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together in conducting an in-depth analysis using PRISMA's systematic review method of all articles collected. This systematic and structured analysis not only enriches our understanding of the topics explored but also sets high standards for future scientific work.

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