



## DIGITALIZATION OF LEARNING AND TEACHER CHALLENGES IN THE CONTEXT OF 21ST-CENTURY GLOBAL EDUCATION

Namira Aulia<sup>1</sup>, Naomi Enjelina Silitonga<sup>2</sup>, Uswatun Hasanah Harahap<sup>3</sup>, Mega Lestaria Sihite<sup>4</sup>

<sup>1,2,3,4</sup> Universitas Negeri Medan, Indonesia

Korespondensi: [Aulianamira527@gmail.com](mailto:Aulianamira527@gmail.com)

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### Abstract

This study aims to analyze the concept of learning digitalization and identify the challenges faced by teachers in the context of 21st-century global education. Digital transformation has shifted the learning paradigm from conventional methods to technology-based approaches, requiring new teacher competencies. Using a literature review of scholarly articles, books, and international education policy reports published in the last ten years, the study thematically identifies patterns, challenges, and teacher adaptation strategies in digitalized learning. Findings indicate that learning digitalization enhances access, flexibility, and global collaboration, but teachers encounter obstacles such as digital literacy gaps, limited infrastructure, increased workload, and the need for continuous professional development. Digital pedagogical competence and critical thinking skills are key to successful implementation. Although limited to available literature and without empirical field data, the study highlights the importance of ongoing training and policy support to strengthen teachers' digital competencies.

**Keywords:** Learning Digitalization, 21st-Century Teachers, Digital Literacy, Global Education, Educational Transformation

## INTRODUCTION

Education in the 21st century reflects a major shift from conventional learning systems toward approaches that are more agile and responsive to future demands. Driven by advances in digital technology, education is no longer confined to the physical boundaries of the classroom; access to information worldwide has become increasingly easy through the internet, enabling learners to pursue self-directed learning beyond school. Yet, alongside these opportunities, significant challenges emerge. Rapid technological change requires continuous updates to curricula to align with the evolving demands of the labor market. Education in the 21st century must integrate critical thinking, creativity, communication, collaboration, and digital skills into students' learning experiences to prepare them for future challenges. The use of technology in learning not only enhances interactivity and depth but also allows personalized learning to meet individual needs (Manyur et al., 2024).

This new era also demands a shift in perspective on educational delivery. In an increasingly digital world, the responsibility for education cannot rest solely on schools as formal institutions. Comprehensive learning success requires strong collaboration among schools, families, and communities—the three main pillars of the educational ecosystem. Such cooperation becomes increasingly vital as global challenges grow more complex and students need to acquire new skills. Schools act as centers for curriculum development that is responsive to contemporary demands, designed to foster mastery of the 4Cs: critical thinking, creativity, collaboration, and communication, which are key competencies for global competitiveness and productivity. Implementing this curriculum requires active, innovative, and collaborative learning models integrated with digital technology (Hasibuan et al., 2025). However, curriculum success cannot rely solely on schools; families, as the first and primary educational environment, must provide support through learning routines, character reinforcement, and continuous guidance in digital literacy. In the digital era, where much learning relies on tools such as computers, smartphones, and online platforms, families are expected not only to provide access but also to monitor technology use, maintain effective communication with teachers, and foster a positive digital culture. Family support in digital literacy helps students become better prepared for increasingly digitized learning processes (Hasibuan et al., 2025).

#### 21st Century Skills

According to Prayogi et al. (2019), 21st-century skills worldwide can be grouped into four categories: (a) ways of thinking, including innovation and creativity, analytical thinking, problem-solving, decision-making, and self-directed learning; (b) ways of working, encompassing communication and collaboration; (c) tools for working, such as general knowledge and skills in information and communication technology; and (d) ways of living, including career management, personal and social responsibility, cultural awareness, and competence (Binkley et al., 2018). These skills are relevant across multiple disciplines and daily life contexts.

21st-century skills are not confined to a specific place in the curriculum. Modern education emphasizes not only skill and knowledge development but also creativity, collaboration, and communication. These skills involve technology use, behavior, moral values, and a focus on critical thinking and communication, presenting unique challenges for teaching and learning. These competencies are often visualized in the “21st Century Knowledge-Skills Rainbow,” a framework developed by the nonprofit organization P21 (Partnership for 21st Century Learning) in Tucson, USA.

The concept of 21st-century skills has transformed educators’ mindsets. While teachers in the past were often seen as selfless mentors guiding students to face life confidently, today’s educators are sometimes perceived merely as professionals delivering content, often limited to knowledge transfer. Such an approach risks producing learning experiences that lack emotional connection and meaningful impact for students.

It is essential for educators to understand that professionalism in the 21st century extends beyond mastering specific content. Teachers should act as facilitators in co-creating knowledge with students, collaborating, and guiding learners to discover

innovation at every stage of learning. 21st-century skills are not merely standards for students; they should also inspire teachers to exemplify values such as trust, openness, perseverance, and commitment, particularly in navigating the challenges of a digitally-driven world.

Learning, at its core, is a deliberate educational act designed to trigger students' learning processes. Its success depends on the quality of instructional programs and the teacher's critical role in structuring learning activities aligned with desired outcomes. As stated in Indonesian Law No. 20 of 2003, the ideal goal of learning is to enable students to actively develop their potential, become spiritually strong, self-controlled, virtuous, intelligent, morally upright, and equipped with skills useful for themselves, society, the nation, and the state. The term "learning" became popular in the 1950s, replacing terms such as "teaching-learning process" and "instruction," which originally stemmed from the word "teaching." Fundamentally, learning is an experience gained through interactions between individuals and their environment in real-life situations (Amelia et al., 2020).

Today, digitalization has moved beyond a mere term, becoming a lifestyle and a new cultural paradigm, including in education. Schools must adapt to produce graduates with competencies aligned with contemporary demands. From an educational perspective, digitalization focuses on enhancing students' skills to ensure they can apply knowledge effectively. Evidence of this includes the emergence of courses and programs specifically aimed at developing digital competencies. Therefore, fostering digital literacy from an early age is essential to prepare future generations to master foundational concepts amid rapid technological progress (Purnasari et al., 2023).

Student competence is closely linked to teacher competence, as the two mutually reinforce each other. Research by Fajrin et al. (2023) indicates that teacher performance has a significant positive impact on student achievement. Furthermore, Wulandari et al. (2022) demonstrate that digital systems enhance students' knowledge and digital competencies. In the realm of digital literacy, the focus extends beyond learning itself to daily applications for both teachers and students (Naila et al., 2021). The success of digitalization in schools depends not only on available facilities but also on the perspectives and competencies of teachers and students, which serve as the primary benchmarks of readiness.

## METHOD

This study employs a literature review as its research design. This method was chosen because the aim of the study is to analyze the digitalization of learning and the challenges faced by teachers in the context of 21st-century global education, as well as their impact on student learning outcomes, using quantitative insights derived from existing literature. The data used are secondary, collected from various sources such as scientific journals, articles, and textbooks relevant to the research topic. Data selection involved screening and identifying literature that is directly related to the study. Data collection was conducted by gathering information from these selected sources, which

were then processed and analyzed to address the research objectives. Content analysis was applied to examine the texts and extract data relevant to the study, identifying recurring themes across the literature. These themes were further analyzed to draw conclusions aligned with the research goals. To ensure data validity and reliability, the study prioritized high-quality, relevant sources and cross-checked the accuracy of the information obtained. Ethical research principles were strictly followed, including maintaining data confidentiality, protecting privacy, and using only legal sources that do not infringe on copyright.

## **RESULTS AND DISCUSSION**

In the present era, the ability to teach using traditional methods is considered less suitable, as student characteristics today differ significantly from those of previous generations, as noted by Kinanthi et al. (2024). Organizations such as UNESCO and OECD emphasize digital literacy as an essential competency in facing the challenges of the Fourth Industrial Revolution and Society 5.0. The concept of 21st-century skills, commonly referred to as the 4Cs—creativity, critical thinking, communication, and collaboration—was systematically popularized by the Partnership for 21st Century Skills (P21) through the Framework for 21st Century Learning, which positions the 4Cs at the core of “Learning and Innovation Skills” (Partnership for 21st Century Skills, 2008). This framework has been reinforced by various international organizations and academic studies, including Thornhill-Miller et al. (2023), who assert that the 4Cs are key competencies for navigating the VUCA (volatile, uncertain, complex, ambiguous) conditions of the 21st-century workforce. These skills are increasingly important as technological advancement, globalization, and automation have shifted demand from hard skills to complex, adaptive, and human-centered soft skills (Thornhill-Miller et al., 2025).

According to Mahrannisya (2023), the 21st century is characterized by the rapid adoption of information and communication technology (ICT) across all areas of life, including classroom learning. Munir (2017) explains that technology has significantly transformed daily human activities, and those unable to keep pace with technological developments risk falling behind in accessing information and opportunities for growth. In the context of an information society or knowledge-based society, access to information is strategic and critical. Thus, integrating ICT in education expands learning opportunities, making education more accessible to all social strata. Understanding the concept of 21st-century learning presents a unique challenge in education. Unlike previous approaches, where students primarily received information from the teacher and completed exercises, 21st-century learning emphasizes student-centered education, focusing on developing learners’ competencies according to their potential, interests, and talents. Accordingly, conventional teaching practices must transform into more innovative, participatory, and relevant instructional models to meet the demands of 21st-century education (Handiyani & Abidin, 2023).

Digitalization of learning is not merely the use of technological devices but also involves transforming teaching methods, strategies, and assessment practices. Online learning platforms such as Google Classroom, Zoom, and Microsoft Teams serve as primary tools for supporting distance and blended learning. However, this shift presents challenges for teachers, as not all possess adequate digital literacy. Additionally, infrastructure gaps and variations in student readiness pose obstacles to the optimal implementation of digital learning.

### **The Role of Teachers in 21st-Century Learning Digitalization**

According to Wohlfart & Wagner (2022), teachers play a central role in educational digitalization. They are not only technology users but also agents of change, responsible for selecting appropriate tools and platforms, designing technology-based learning activities, and assessing learning outcomes using new methods. The success of digitalization implementation heavily depends on teachers' digital competencies, including digital literacy, pedagogical skills for online or hybrid learning, and digital classroom management strategies. Training that emphasizes digital pedagogy, rather than just technical skills, has been shown to improve the quality of learning processes.

However, several challenges remain, both internal and external. External obstacles include infrastructure limitations such as connectivity and devices, as well as a lack of managerial support or mentoring for teachers. Internal challenges involve resistance to technology, traditional pedagogical habits, and teachers' self-confidence. Therefore, Teacher Professional Development (TPD) programs that are continuous and contextual—combining technical training, hands-on practice, teacher collaboration, and implementation support—are crucial. Empowered teachers with adequate digital competencies and support demonstrate increased student engagement, diverse learning strategies (e.g., personalized or project-based learning), and more optimal learning outcomes.

### **Challenges for Teachers in 21st-Century Learning Digitalization**

Mahrannisya (2023) and related studies highlight several challenges teachers face in implementing digital learning:

1. Infrastructure and Technology Access Gaps – Differences in connectivity and device availability between urban and rural areas hinder digital learning implementation and can widen educational disparities (Azri & Raniyah, 2024).
2. Limited Digital Competencies – Not all teachers possess the skills to operate or optimize educational technology. A lack of ongoing training and professional development programs in digital literacy is a significant barrier.
3. Paradigm Shift and Resistance to Technology – Moving from traditional to technology-based learning requires a fundamental change in teachers' mindsets. Some educators resist due to limited understanding of technology's importance or discomfort in using it (Hendrik Dewantara, 2024).

4. Digital Security and Ethics Issues – Teachers are responsible for ensuring student data safety, complying with regulations, and instilling ethical technology use so that students can act wisely and responsibly in digital spaces.
5. Time Constraints and Workload – Integrating technology requires complex planning and material adjustments, adding to teachers' workload. Without institutional support in the form of policies, training, or facilities, teachers struggle to balance digital innovation with other professional responsibilities.

Overall, 21st-century learning digitalization positions teachers as the main drivers, with adequate digital competencies and professional support as key factors for success. Technical, pedagogical, and psychological obstacles must be addressed through continuous professional development, collaboration, and supportive policies to ensure effective educational digital transformation.

## **Discussion**

The results of this study indicate that learning digitalization has become a major driver in transforming teaching methods in the 21st century. Consistent with previous findings, such as those reported by Mahrunnisya (2023) and Kinanthi et al. (2024), technology integration not only enhances the effectiveness of the learning process but also expands access to diverse learning resources. This suggests that digitalization not only changes teaching methods but also creates new opportunities for students to develop their competencies and creativity.

Furthermore, this study confirms the working hypothesis that teachers' pedagogical and digital competencies significantly influence student learning outcomes. Thornhill-Miller et al. (2025) provide empirical support for the importance of digital skills in addressing the challenges currently faced in education. Teachers are no longer merely information providers; they must act as facilitators, motivators, and innovators in creating interactive learning environments.

However, teacher performance cannot be separated from the real-world challenges they face. The findings reveal several obstacles, including infrastructure gaps in various regions, which serve as major barriers to digitalization implementation. Communities in remote areas often lack adequate access to technology, creating disparities in education quality. Future research should focus on developing inclusive models to bridge these gaps, such as infrastructure support programs for schools in underprivileged areas.

In the context of professional development, our findings emphasize the importance of training that focuses on digital pedagogy rather than merely technical skills. Integrated and continuous training has proven more effective in enhancing teachers' ability to apply technology in their teaching. Through this approach, teachers are better prepared to adopt innovative and responsive learning methods tailored to students' needs.

Meanwhile, challenges related to resistance to technology require deeper exploration. Many educators feel uncomfortable adopting new innovations, often due to limited understanding of the benefits of technology in education. Therefore, professional

development programs should not only provide technical skills but also foster positive attitudes toward technology use.

From a policy perspective, these findings carry significant implications. Policymakers must ensure that managerial support and infrastructure are not only available but also sustainable. Collaboration between government, schools, and communities should be strengthened to create an inclusive educational environment where all students have equal access to the necessary learning technologies.

For future research directions, studies should explore the long-term impacts of teacher training in the context of learning digitalization. Longitudinal research that observes the development of teachers' digital competencies and student learning outcomes over time would be highly valuable. Additionally, the influence of social, cultural, and economic contexts on digitalization adoption should be studied to ensure that proposed solutions are relevant and impactful.

Overall, the findings of this study not only provide new insights into learning digitalization but also underscore the need for multisectoral collaboration. All educational stakeholders schools, teachers, parents, and policymakers must work together to create an educational ecosystem that supports the development of students' digital competencies, preparing them to face global challenges in an increasingly complex era.

## CONCLUSION

This study confirms that learning digitalization is a crucial step in preparing students to face global challenges in the 21st century. The findings indicate that while digitalization can enhance access, flexibility, and collaboration, infrastructure gaps and insufficient digital competencies among teachers remain major challenges that must be addressed. The results highlight the importance of professional development for teachers to support the integration of technology in teaching. Therefore, continuous and integrated training should be prioritized, especially in schools with limited resources. Ensuring students have adequate access to devices and connectivity is also critical for improving their digital skills. The involvement of all stakeholders, including parents, communities, and policymakers, is essential to create an inclusive learning environment. Strong collaboration between schools and industry can also help address resource shortages and provide the necessary support for developing students' digital competencies.

Overall, achieving quality education in the digital era requires shared awareness and concerted efforts to overcome existing challenges. Through a comprehensive, collaboration-focused approach, all students can be given equal opportunities to learn and thrive in an ever-changing world.

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