Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

A Holistic Strategy for Developing 21st Century Skills and Leveraging Technology to Address the Challenges of the Digital Era

Putri Novira Ariyanti[1]* https://orcid.org/0009-0006-1339-7344
R Madhakomala[2] https://orcid.org/0000-0003-1038-9454
Hana Taqiyya[3] https://orcid.org/0009-0003-0343-5763

[1,2,3]Faculty of Education, State University of Jakarta, Jakarta, Indonesia
**Corresponding author: putrinovira15@gmail.com*

ABSTRACT

The rapid advancement of technology and social change in the digital era has created new demands on education systems. Students are expected not only to master academic knowledge but also to develop essential 21st century competencies such as critical thinking, collaboration, creativity, digital literacy, and strong personal character. Although these n eeds are widely recognized, many educational systems still lack a holistic and coherent strategy to integrate these skills effectively. This study aims to formulate an integrated strategy that combines core 21st century competencies with the meaningful use of educational technology. A qualitative method was used through a systematic review of academic journals, books, and official policy documents published between 2015 and 2025. Thematic analysis was applied to identify key dimensions, patterns, and challenges in current practices. The results reveal the need for a comprehensive model that supports not only cognitive development but also emotional, practical, and digital skills. In response to this gap, the study proposes a unified educational framework that connects curriculum, pedagogy, and technology in a flexible and responsive manner. The proposed model provides practical guidance for educators, curriculum developers, and policymakers to strengthen the relevance of education in the 21st century. This study contributes to the development of inclusive, interdisciplinary, and technology-supported learning environments that promote meaningful, future-ready education for all learners.

ARTICLE INFO

Keywords:
21st century skills; educational technology; holistic education; digital learning; education in the digital era.

Article History:
Received: July 3, 2025
Revised: October 2, 2025
Accepted: December 19, 2025
Published: December 30, 2025

How to Cite in APA Style:
Ariyanti et al., (2025). A Holistic Strategy for Developing 21st Century Skills and Leveraging Technology to Address the Challenges of the Digital Era. *Journal of Education, Religious, and Instructions,* vol 3 (2), 60-71

Introduction

The rapid advancement of digital technologies has profoundly transformed the global educational landscape. Schools and universities are now required to rethink how they deliver content, assess learning, and cultivate competencies relevant to a world shaped by automation, artificial intelligence, and real-time information networks (Zou et al., 2025). These technological changes demand not only access to devices and platforms, but also a reorientation of educational goals that emphasizes adaptability, innovation, and lifelong learning.

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

In response to this transformation, the integration of 21st century skills has become a global educational priority. These competencies encompass cognitive abilities such as critical thinking, interpersonal skills such as collaboration, intrapersonal attributes such as self-regulation, and digital literacies such as information and media literacy (OECD, 2021; UNESCO, 2021). International frameworks, including UNESCO's Four Pillars of Learning and the OECD's Learning Compass 2030, consistently highlight the need for multidimensional skills that prepare learners to thrive in dynamic and uncertain contexts. Beyond technical expertise, character education, which emphasizes empathy, ethical reasoning, and responsibility, has also gained prominence as an essential foundation for digital citizenship (Huschle, 2024).

Although the importance of these competencies is widely recognized, existing initiatives often remain fragmented. Many reforms focus narrowly on isolated skill sets, such as creativity or digital fluency, while neglecting the holistic nature of learning that connects cognitive, emotional, practical, and moral dimensions. This fragmentation is reinforced by rigid curriculum structures, limited teacher readiness, and insufficient system-wide policy support (Pare & Sihotang, 2023). Here lies the research gap: despite abundant studies on individual aspects of 21st century education, there is still a lack of comprehensive frameworks that integrate curriculum, pedagogy, and technology into a coherent and adaptable strategy.

This study seeks to address that gap by proposing a holistic educational framework that unites 21st century competencies with meaningful technology integration. By employing a systematic literature review, the research identifies patterns, challenges, and opportunities across global and national contexts. The significance of this study lies in its potential to provide practical guidance for educators, curriculum developers, and policymakers to design inclusive, future-ready learning environments. Furthermore, the framework introduced contributes to the development of resilient education systems that can adapt to technological disruption while nurturing well-rounded learners.

Method

This study employed a qualitative, systematic literature review (SLR) to construct a holistic strategy for 21st century skill development and technology integration in education. The systematic approach was chosen to ensure transparency, replicability, and comprehensive coverage of the available scholarship (Kitchenham & Charters, 2007; Snyder, 2019).

Research Design

Following established SLR protocols (Kitchenham & Charters, 2007), the review was conducted in four phases: planning the review, identifying and screening relevant literature, extracting and coding data, and synthesizing findings through thematic analysis. To improve methodological rigor, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework (Page et al., 2021) was applied to document the search strategy, screening decisions, and article selection process.

Data Sources and Selection Criteria

The literature search was carried out across four major academic databases: Scopus, Web of Science, ERIC, and Google Scholar. These were chosen to ensure coverage of both high-

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

impact journals and education-specific publications. To complement database searches, manual searches of reference lists from relevant review articles, policy reports, and books were also performed. Boolean search strings were used, combining keywords such as "21st century skills", "digital literacy", "holistic education", "technology integration", and "curriculum design". The initial database query produced 1,247 records, which were then exported to reference management software for screening and duplication checks.

Inclusion and Exclusion Criteria

To maintain quality and relevance, publications were included if they met the following criteria: they were published between 2015 and 2025; focused on K–12 or higher education contexts; addressed at least one domain of 21st century skills such as cognitive, socio-emotional, psychomotor, or digital; discussed technology-supported pedagogy or curriculum innovation; and were published in English in peer-reviewed journals, academic books, or official policy documents.

Exclusion criteria were applied to filter out studies that did not meet the research focus. Publications were excluded if they were written in languages other than English, if they were opinion pieces or essays without an empirical or conceptual framework, if they were duplicate records, or if they examined contexts outside formal education such as workplace-only training programs.

Data Extraction and Coding Procedures

A standardized data extraction template was used to collect bibliographic information, research context, methodology, skill domains, and major findings. Two independent reviewers coded the articles to reduce bias. Any discrepancies in coding were discussed until consensus was reached, thereby improving inter-rater reliability (Okoli & Schabram, 2010).

Data Analysis and Trustworthiness

Thematic analysis was conducted following Braun and Clarke (2022) to identify recurring themes, dimensions, and gaps in the literature. Codes were grouped into higher-order categories that aligned with the study's conceptual framework, specifically cognitive, affective, psychomotor, and digital domains. Credibility was ensured through analyst triangulation and member checking with external experts, while dependability and confirmability were strengthened through the use of an audit trail documenting search strings, screening decisions, inclusion criteria, and codebooks.

Findings

Characteristics of 21st Century Skills

21st century skills refer to a set of competencies essential for learners to thrive, innovate, and contribute in a rapidly evolving digital society. Leading organizations such as P21, OECD, and UNESCO have outlined frameworks that emphasize cognitive, technological, social-emotional, and character domains (Binkley et al., 2012).

Table 1. below presents a comparison of 21st century skill dimensions across major international institutions:

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

Table 1. Dimensions of 21st Century Skills by Leading Organizations

No.	Organization	Dimensions of 21st Century Skills	Main Emphasis
1	P21 (Partnership for 21st Century Learning)	4Cs (critical thinking, communication, collaboration, creativity); information/media/technology literacy; character	Global collaboration and work readiness
2	OECD – Learning Compass 2030	Cognitive, social-emotional, metacognitive skills; values and attitudes	Well-being and lifelong learning
3	UNESCO – Education 2030	Four Pillars: learning to know, to do, to live together, and to be	Holistic human development
4	Kemendikbudristek – Profil Pelajar Pancasila	Faith, independence, collaboration, critical reasoning, creativity, global diversity	National character and 21st-century readiness

(*Source: Adapted from P21, OECD, UNESCO, Kemendikbudristek, 2022*)

These competencies are often classified into three broad domains:

1 Cognitive and Intellectual Skills, such as critical thinking and problem-solving.
2 Digital and Technology Literacies, including information/media literacy and ethical digital usage.
3 Character and Socio-Emotional Qualities, such as empathy, responsibility, and leadership.

Understanding these categories is fundamental to designing a responsive, comprehensive, and future-oriented educational approach (Zhao, 2012).

Holistic Dimensions in 21st Century Education

21st century education requires a holistic approach that integrates all aspects of human development: cognitive, affective, psychomotor, social, and spiritual. This approach goes beyond content mastery, emphasizing the formation of character, social skills, emotional awareness, and core human values (UNESCO, 2015). The development of 21st century skills can only reach its full potential when education facilitates learners' comprehensive growth.

The cognitive dimension includes critical thinking, problem-solving, and data-informed decision-making. Yet, cognitive advancement must be supported by affective abilities such as empathy, intrinsic motivation, and self-awareness, which influence emotional regulation and learning attitudes (Goleman, 2006). Emotional intelligence is a key to fostering meaningful communication and collaboration in the digital society.

The psychomotor dimension becomes increasingly relevant in practical competencies, such as operating digital tools, using technology, and performing life skills that require coordination between hands, eyes, and mind. These skills are essential in digital product creation, online learning platforms, and project-based learning (Krajcik & Blumenfeld, 2006).

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

Additionally, social and spiritual dimensions play crucial roles in shaping 21st century learners' identities. Education that nurtures values like cooperation, tolerance, and social responsibility prepares students to become agents of change with collective awareness and global ethics (OECD, 2019). In the Indonesian context, the spiritual dimension is embedded through the application of Pancasila values in daily educational practices, as illustrated in the *Profil Pelajar Pancasila* (Kemendikbudristek, 2022).

Thus, holistic education enables students to "learn to know, learn to do, learn to live together, and learn to be," as stated in Delors' Four Pillars of Learning (Delors, 1996). This approach is essential to navigate the complexity of the 21st century and prepare students not only as skilled workers but as whole human beings.

Technology Integration in Competency Development

The advancement of digital technology has provided significant opportunities for education to transform learning approaches and foster student competencies. Technology integration is not limited to accelerating access to information, but also expands learning spaces to become more adaptive, personalized, collaborative, and contextual (Redecker et al., 2011). In the 21st century skills framework, technology serves as a catalyst for learning, empowering students to think critically, creatively, and constructively within dynamic digital environments.

One prominent example of this integration is the use of digital-based learning platforms such as Learning Management Systems (LMS), artificial intelligence, and adaptive learning systems that allow students to learn at their own pace and according to their personal styles (Schmid et al., 2021). These platforms support lifelong learning by promoting autonomy, self-reflection, and continuous skill development.

Furthermore, social media and online collaboration tools enhance communication and global collaboration skills. Platforms such as Google Workspace, Padlet, and Microsoft Teams have been shown to increase student engagement in interschool and international projects, promoting intercultural awareness and collective problem-solving (Greenhow & Lewin, 2016).

Despite these benefits, effective technology integration requires adequate infrastructure, teacher digital competence, and supportive policies. Challenges remain, including the digital divide, low digital literacy among educators, and the lack of curricula responsive to technological change (Nugroho & Mutiaraningrum, 2020). Therefore, technology should not merely be viewed as a tool but as an integral part of a well-designed, pedagogically grounded, and inclusive learning process.

Challenges and Opportunities of Digital Transformation in Education

The digital transformation in education presents two interrelated aspects: challenges and opportunities. On one hand, technology offers significant potential to improve the quality of learning, expand educational access, and cultivate lifelong learning habits. On the other hand, it brings about new structural and cultural challenges that must be addressed to avoid deepening existing inequalities (Selwyn, 2016).

One of the primary challenges is the digital access and infrastructure gap, particularly between urban and rural areas. UNESCO data indicates that more than 50% of students in developing countries lack adequate internet access or digital devices at home, exacerbating

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

educational inequality during and after the pandemic (UNESCO, 2021). This situation calls for affirmative government policies to ensure equitable and affordable digital infrastructure.

Another critical issue is teacher readiness. Many educators still lack sufficient technological competence to integrate ICT effectively into their pedagogical practices (Putra & Agustina, 2022). Additionally, online learning requires a shift from traditional teacher-centered approaches to more learner-centered and project-based pedagogies.

Nonetheless, the opportunities presented by digital transformation are substantial. Technology enables flexible and hybrid learning, strengthens cross-geographical collaboration among students, and provides access to Open Educational Resources (OER). With the right strategies, technology can accelerate the development of 21st century skills, including digital literacy, critical thinking, and independent learning (OECD, 2021).

Furthermore, digital transformation compels schools and educational institutions to innovate in assessment systems, data management, and platform-based teacher training. This evolution paves the way for an education system that is more adaptive, data-driven, and inclusive, provided it is managed with ethical considerations, security, and a strong commitment to digital equity.

Discussion

21st Century Skills as a Response to Technological Disruption

The digital revolution, marked by rapid advancements in information technology, artificial intelligence, and automation, has profoundly transformed education and other sectors. These disruptions reshape how people work, communicate, and learn, requiring the cultivation of new skills aligned with 21st century demands (World Economic Forum, 2020). In this context, 21st century skills are no longer optional but essential for academic, professional, and social survival. This observation echoes the need for reorientation of educational goals highlighted in earlier studies, which emphasize adaptability, innovation, and lifelong learning as central aims of contemporary education (Zou et al., 2025).

The most widely recognized 21st century competencies are the "4Cs": critical thinking, creativity, collaboration, and communication. These are critical not only for academic success but also for navigating a volatile and uncertain global workforce (Trilling & Fadel, 2009). For example, critical thinking enables learners to analyze complex problems, while creativity supports the development of innovative and contextually relevant solutions. These findings align with international frameworks such as the OECD's Learning Compass 2030 and UNESCO's Four Pillars of Learning, which emphasize multidimensional skills as prerequisites for thriving in dynamic societies (OECD, 2021; UNESCO, 2021).

Technological disruption has further underscored the urgency of mastering digital, information, and media literacies. In an age of information overload, students must develop the ability to evaluate sources critically, identify bias, and use digital platforms ethically and productively (Ng, 2012). Without these literacies, learners risk misinformation, polarization, and digital dependency. This need reflects the holistic approach described in the introduction, where digital competencies must be integrated with cognitive, interpersonal, and intrapersonal dimensions to avoid fragmented educational practices (Pare & Sihotang, 2023).

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

Beyond cognitive and digital domains, 21st century education also requires socio-emotional and character development, including resilience, empathy, curiosity, and ethical reasoning. The OECD (2019) highlights the importance of integrating cognition (head), values (heart), and practical action (hand) to develop well-rounded individuals. Similarly, Huschle (2024) emphasizes that empathy, responsibility, and ethical participation are essential components of digital citizenship in today's interconnected world. Indonesia's Profil Pelajar Pancasila reflects this principle at the national level, embedding faith, collaboration, and independence as key values for preparing globally competent learners (Kemendikbudristek, 2022).

In short, 21st century skills represent a strategic response to structural changes driven by digital transformation. Their effective integration into curriculum, pedagogy, and policy is necessary to ensure that learners are not only technologically proficient but also emotionally resilient, ethically grounded, and socially engaged. These findings reinforce the research gap identified earlier, namely the lack of holistic strategies that connect cognitive, affective, psychomotor, and digital domains within a coherent educational framework.

Technology as a Catalyst for Deep Learning

Building on the urgency of 21st century competencies, technology plays a pivotal role in creating learning experiences that are deeper, more reflective, and more meaningful. In education, technology is not merely a supporting tool but functions as a catalyst for transformation. Deep learning emphasizes conceptual understanding, cross-disciplinary integration, and the application of knowledge to authentic contexts (Fullan et al., 2018). These goals are aligned with international frameworks such as UNESCO's Four Pillars of Learning and the OECD Learning Compass 2030, which emphasize lifelong learning, interdisciplinarity, and adaptability as essential responses to technological disruption (OECD, 2021; UNESCO, 2021).

Digital platforms such as Learning Management Systems (LMS), Augmented Reality (AR), game-based simulations, and Artificial Intelligence (AI) provide immersive environments that encourage exploration, experimentation, and personalized pathways. These tools have been shown to foster learner autonomy, intrinsic motivation, and higher-order thinking skills (Hattie & Zierer, 2019). Such findings resonate with the argument presented by Zou et al. (2025) that educational goals must be reoriented toward adaptability and innovation to remain relevant in a digitally interconnected world.

A defining feature of technology-supported deep learning is interactivity and real-time feedback. Platforms such as Google Classroom and Edmodo allow teachers to provide immediate feedback, while also extending discussions beyond the classroom. Furthermore, technology enables collaborative and problem-based learning models, which help students synthesize information across domains and apply it in real-world scenarios (Bell, 2010). This is consistent with the global call for multidimensional competencies that integrate cognitive, interpersonal, and digital skills (OECD, 2021).

However, these benefits cannot be realized without equipping teachers to act as facilitators of technology-enhanced learning. Strong pedagogical foundations, not just technical competence, are essential for meaningful technology integration. The TPACK framework (Technological Pedagogical Content Knowledge) provides a promising guide for teacher professional development in this regard (Mishra & Koehler, 2006). Yet, as Pare

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

and Sihotang (2023) observe, many educational systems remain constrained by rigid curricula and limited teacher readiness, leading to fragmented rather than holistic integration of technology.

In summary, technology can act as a catalyst for deep learning when aligned with curriculum goals and sound pedagogy. It has the potential to transform education into a more interactive, adaptive, and inclusive process, but its effectiveness depends on system-wide strategies that address teacher preparation, curriculum design, and equity of access. This reinforces the research gap highlighted earlier, namely the absence of comprehensive frameworks that combine technological tools with cognitive, affective, and socio-emotional dimensions of learning.

The Urgency of a Holistic Strategy: Integrating Curriculum, Pedagogy, and Technology

The development of 21st century skills and the effective use of technology cannot be achieved through fragmented or isolated efforts. A holistic strategy is required, one that integrates curriculum, pedagogical approaches, and technological infrastructure into a coherent and sustainable system. Without such synergy, education risks being confined to bureaucratic routines or adopting technology superficially with limited impact on learning quality. This concern directly reflects the gap identified in the introduction, where initiatives often remain fragmented due to rigid curriculum structures, inadequate teacher readiness, and limited policy support (Pare & Sihotang, 2023).

From a curriculum perspective, the emphasis on 21st century competencies requires cross-disciplinary integration and the application of contextual learning models. A modern curriculum must move beyond rote content delivery to cultivate transversal competencies such as critical thinking, collaboration, and complex problem solving (Voogt & Roblin, 2012). Indonesia's Kurikulum Merdeka demonstrates this approach by promoting interdisciplinary projects and reinforcing the Profil Pelajar Pancasila as a framework that balances global competencies with local cultural values (Kemendikbudristek, 2022). This aligns with UNESCO's Four Pillars of Learning, which stress learning to know, to do, to live together, and to be as inseparable dimensions of holistic education (UNESCO, 2021).

Pedagogically, active, collaborative, and learner-centered methods are essential to realize these competencies. Strategies such as inquiry-based learning, project-based learning, and blended learning have consistently proven effective in fostering deep engagement and transferable skills when guided by sound instructional design (Larson & Miller, 2011). Teachers therefore must transition from being mere content deliverers to facilitators of reflective, meaningful, and student-driven learning experiences. This vision resonates with OECD's Learning Compass 2030, which highlights learner agency and co-agency as central to preparing future-ready graduates (OECD, 2021).

The third pillar is technology, which is only effective when aligned with pedagogical purpose. The use of LMS platforms, collaborative tools, and open educational resources should be embedded in curriculum goals and responsive to diverse student learning styles. The TPACK framework (Mishra & Koehler, 2006) provides a comprehensive guide for equipping educators with the integrated knowledge needed for such purposeful technology use. At the same time, policymakers must address equity issues by investing in infrastructure and training to ensure that technological benefits are accessible to all learners, thereby reducing the digital divide.

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

Implementing a holistic strategy is essential not only for improving learning outcomes but also for building resilient education systems that can adapt to future uncertainties. When curriculum, pedagogy, and technology are deliberately integrated, education evolves into a transformative force one that develops intellectually capable, ethically grounded, and socially responsible learners able to navigate the complexities of the digital era. This reinforces the novelty of the present study, which offers a framework for bridging the fragmented initiatives noted in previous literature into a systemic and sustainable educational model.

Implications for Policy and Practice

The findings of this study carry important implications for both educational policy and classroom practice. At the policy level, there is a pressing need for systemic reforms that embed 21st century competencies into national curriculum frameworks in a coherent and measurable manner. This aligns with UNESCO (2021) and OECD (2021), which stress that curriculum should integrate cognitive, socio-emotional, and digital domains while also promoting values and ethics as foundations for digital citizenship. Policymakers must therefore ensure that curricular standards explicitly reflect transversal skills such as critical thinking, collaboration, resilience, and digital literacy.

Teacher professional development also emerges as a critical policy priority. As highlighted in the introduction, fragmented initiatives often stem from insufficient teacher readiness (Pare & Sihotang, 2023). To address this, governments and institutions should adopt the TPACK framework (Mishra & Koehler, 2006) as a guiding model for teacher training programs. This would help educators integrate pedagogy, content knowledge, and technology in ways that enhance learning quality. Large-scale, sustained, and practice-oriented training initiatives are necessary to move beyond ad-hoc workshops toward long-term professional growth.

At the classroom level, educators must transition from content-centered approaches to more learner-centered and technology-supported strategies. Methods such as project-based learning, blended learning, and inquiry-based learning not only support the acquisition of 21st century skills but also nurture character and socio-emotional growth. The Profil Pelajar Pancasila provides a useful national framework for ensuring that such pedagogical practices are locally grounded while maintaining global relevance (Kemendikbudristek, 2022). Teachers should also leverage digital tools to personalize learning, provide real-time feedback, and promote collaborative problem solving across disciplines.

Finally, addressing equity and access remains an urgent implication. Without adequate infrastructure and support, technology integration risks exacerbating inequality between well-resourced and under-resourced schools. Policymakers should prioritize investments in digital infrastructure, provide subsidies for disadvantaged learners, and design inclusive policies to close the digital divide. Such measures ensure that the benefits of holistic, technology-enhanced education are equitably distributed.

In short, these findings underscore the necessity of aligning curriculum reform, teacher professional development, and equitable technological investment within a unified strategy. Doing so will enable education systems to prepare learners who are not only competent and innovative, but also resilient, ethical, and socially responsible in the face of ongoing digital transformation.

Journal of Education, Religious, and Instructions (JoERI)
E-ISSN: 3025-3012
Volume 3 Number 2, December 2025, page 60-71
Doi: 10.60046/joeri.v3i2.229
https://ejournal.stiab-jinarakkhita.ac.id/index.php/joeri

Conclusion

This study demonstrates that aligning curriculum, learner-centered pedagogy, and purposeful technology integration is essential to cultivate holistic 21st century competencies. The findings confirm that technology can act as a catalyst for deep learning when supported by sound instructional design and teacher readiness.

Policymakers should: (1) revise national curriculum standards to embed measurable 21st century competencies across all subjects; (2) invest in large-scale teacher professional development grounded in the TPACK framework; and (3) allocate resources to reduce the digital divide, ensuring equitable access to digital tools. Educators should adopt project-based and blended learning models with integrated socio-emotional assessment, while curriculum developers should ensure transversal skills are systematically embedded across disciplines.

Ultimately, this study advocates a transformative and systemic reform that integrates 21st century skills and technology. Such a holistic approach is not optional, but a strategic imperative for preparing learners to thrive in the uncertainties of the digital age.

References

Beers, S. Z. (2011). *21st century skills: Preparing students for their future*. Alexandria, VA: National Education Association.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 17–66). Springer. https://doi.org/10.1007/978-94-007-2324-5_2

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. London, UK: SAGE.

Council for Curriculum Redesign. (2024). *Designing modern curricula: Frameworks for future-ready education*. Cambridge, UK: CCR Press.

Delors, J. (1996). *Learning: The treasure within – Report to UNESCO of the International Commission on Education for the twenty-first century*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000109590

Fullan, M., Quinn, J., & McEachen, J. (2018). *Deep learning: Engage the world change the world*. Thousand Oaks, CA: Corwin Press.

Goleman, D. (2006). *Social intelligence: The new science of human relationships*. New York, NY: Bantam Books.

Greenhow, C., & Lewin, C. (2016). Social media and education: Reconceptualizing the boundaries of formal and informal learning. *Learning, Media and Technology, 41*(1), 6–30. https://doi.org/10.1080/17439884.2015.1064954

Hattie, J., & Zierer, K. (2019). *Visible learning insights*. New York, NY: Routledge.

Huschle, L., Kindlinger, M., & Abs, H. J. (2024). Personal Responsibility and Beyond: Developing a Comprehensive Conceptualization of Digital Citizenship Competences. *Weizenbaum Journal of the Digital Society*, *4*(4). https://doi.org/10.34669/wi.wjds/4.4.5

Kemendikbudristek. (2022a). *Panduan implementasi Kurikulum Merdeka*. Jakarta: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Kemendikbudristek. (2022b). *Profil Pelajar Pancasila*. Jakarta: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Kitchenham, B., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering* (EBSE Technical Report 2007-001). Keele University & University of Durham.

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 317–334). Cambridge, UK: Cambridge University Press.

Larson, L. C., & Miller, T. N. (2011). 21st century skills: Prepare students for the future. *Kappa Delta Pi Record, 47*(3), 121–123. https://doi.org/10.1080/00228958.2011.10516575

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education, 59*(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016

Nugroho, A., & Mutiaraningrum, I. (2020). EFL teachers' beliefs and practices about digital learning of English. *Edulite: Journal of English Education, Literature, and Culture, 5*(2), 304–321. https://doi.org/10.30659/e.5.2.304-321

OECD. (2019). *OECD future of education and skills 2030: Conceptual learning framework*. OECD. https://www.oecd.org/education/2030-project/

OECD. (2021). *OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots*. OECD Publishing. https://doi.org/10.1787/589b283f-en

Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1954824

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Pare, A., & Sihotang, H. (2023). Pendidikan holistik untuk mengembangkan keterampilan abad 21 dalam menghadapi tantangan era digital. *Jurnal Pendidikan Tambusai, 7*(3), 27778–27787. https://doi.org/10.31004/jptam.v7i3.6514

Putra, Z. A., & Agustina, E. (2022). Teacher digital competence in post-pandemic education: A systematic review. *Jurnal Pendidikan Teknologi dan Kejuruan, 28*(2), 145–159. https://doi.org/10.21831/jptk.v28i2.51879

Razak, N. K., Rachman, F., Tung, K. Y., & Judijanto, L. (2025). Integrating digital literacy, critical thinking, and collaborative learning: Addressing contemporary challenges in 21st century education. *Journal of Hunan University Natural Sciences, 52*(3), 74–85. https://doi.org/10.55463/issn.1674-2974.52.3.9

Redecker, C., Ala-Mutka, K., Bacigalupo, M., Ferrari, A., & Punie, Y. (2011). *The future of learning: Preparing for change*. Luxembourg: Publications Office of the European Union.

Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R. M., Abrami, P. C., Wade, A., … & Woods, J. (2021). Technology's effect on student achievement and interest: A meta-analysis. *Journal of Educational Computing Research, 59*(2), 313–349. https://doi.org/10.1177/0735633120967317

Selwyn, N. (2016). *Education and technology: Key issues and debates* (2nd ed.). London, UK: Bloomsbury Publishing.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco, CA: Jossey-Bass.

UNESCO. (2015). *Rethinking education: Towards a global common good?* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000232555

UNESCO. (2021a). *Futures of education: Learning to become*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000374071

UNESCO. (2021b). *Reimagining our futures together: A new social contract for education*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000377255

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies, 44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938

World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum. https://www.weforum.org/reports/the-future-of-jobs-report-2020

Zhao, Y. (2012). *World class learners: Educating creative and entrepreneurial students*. Thousand Oaks, CA: Corwin Press.

Zou, Y., Kuek, F., Feng, W., & Cheng, X. (2025). Digital learning in the 21st century: Trends, challenges, and innovations in technology integration. *Frontiers in Education, 10*, Article 1562391. https://doi.org/10.3389/feduc.2025.1562391