SOUTHEAST ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
E-ISSN: 2672-2992
www.sajst.org

A Literature Review of Empirical Studies on 21st Century Teaching and Learning Strategies

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Article Info:
Received: ***20 June 2025;*** *Revised:* ***27 Aug 2025;*** *Accepted:* ***22 Oct 2025****; Available Online:* ***15 Dec 2025***

Abstract *— This literature review synthesizes empirical studies on 21st-century teaching and learning strategies, highlighting the effectiveness of student-centered approaches, digital integration, collaborative learning, the development of critical thinking, and innovative pedagogical models. Findings show that technology-enhanced instruction, active learning, and competency-based frameworks significantly improve student engagement and learning outcomes. The review also identifies gaps in implementation, digital equity challenges, and the need for professional development. Overall, the evidence underscores the importance of adaptive, innovative, and learner-focused strategies in preparing students for modern academic and professional environments.*

Keywords - *21st-century education, teaching strategies, Learning strategies, Empirical studies, Student-centered learning, Innovative pedagogy, Critical thinking, Collaboration and creativity, Digital literacy, Blended learning, Project-based learning, educational innovation*

INTRODUCTION

The rapid advancements in technology and Globalization have transformed the educational landscape in the 21st century. More dynamic, learner-centered approaches are gradually replacing traditional teaching methods that emphasize rote memorization and teacher-centered instruction.

These strategies aim to develop critical thinking, creativity, communication, and collaboration—skills essential for students to thrive in an increasingly complex and interconnected world (P21, 2019). Understanding 21st-century teaching and learning strategies is therefore crucial for educators who wish to prepare learners for real-world challenges and lifelong learning (Darling-Hammond, Barron, Pearson, et al., 2008). Recent studies have highlighted various innovative strategies that enhance 21st-century learning. These include project-based learning (PBL) (Rehman, Huang, AlGerafi, & Javed; Johnson and Lee, 2023), flipped classrooms, blended learning (Ally, 2019; Anderson and Dron, 2011), and the integration of digital tools such as learning management systems, virtual simulations, and artificial intelligence (Zou, Kuek, Feng, & Cheng, 2023). Empirical research by Trilling and Fadel (2009) and by Voogt & Roblin (2012) emphasized the importance of technology-enhanced learning environments in promoting collaboration and critical thinking. Moreover, the widespread adoption of online learning platforms and educational apps has made learning more flexible and accessible (Ally, 2019; Zou, Kuek, Feng, & Cheng, 2023), aligning with students' diverse needs and learning styles. Despite these advancements, several challenges persist in implementing 21st-century teaching and learning strategies (Patel, 2024; Martinez and Santos, 2024). Many educators lack sufficient training in digital pedagogy, while schools in developing regions often face limited access to technological resources. Additionally, disparities in internet connectivity and

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
E-ISSN: 2672-2992
www.sajst.org

digital literacy hinder equitable learning opportunities. Empirical findings also reveal that some teachers struggle to shift from traditional roles to facilitators of learning, which affects the effective integration of modern strategies in classrooms (Martinez and Santos, 2024). These limitations highlight the complexity of transforming education to meet 21st-century standards. While existing studies have examined individual teaching strategies and technologies, there remains a need for comprehensive research that synthesizes empirical evidence on how these methods collectively influence student engagement and achievement. Most prior works focus on specific contexts or subjects, leaving gaps in understanding their broader applicability across educational levels and cultural settings. Therefore, further empirical investigation is essential to identify best practices, assess their effectiveness (Acma and Ducot, 2024), and provide data-driven recommendations for educators and policymakers. This study aims to analyze empirical research on 21st-century teaching and learning strategies to identify common themes, strengths, and challenges in their implementation. Specifically, it seeks to (1) examine the pedagogical frameworks underlying modern teaching strategies (Katsara and De Witte; Stehle and PetersBurton, 2019), (2) assess their impact on student outcomes (Acma and Ducot), and (3) explore factors that influence their successful integration in educational settings (Abadiano, 2023; Martinez and Santos, 2024).

This review will focus on answering the following questions.

1. What empirical evidence exists regarding the effectiveness of 21st-century teaching and learning strategies?
2. What challenges and limitations do educators face in implementing these strategies?
3. What recommendations can be drawn to improve the adoption of 21st-century teaching and learning approaches?

These studies on 21st-century teaching and learning strategies show that modern education is increasingly shifting toward learner-centered, technology-driven, and skill-based approaches that foster critical thinking, creativity, collaboration, and communication (Isayev and Köprülü, 2022; Levin, Semenov, and Gorsky, 2021). While techniques such as project-based learning (Rehman, Huang, AlGerafi, & Javed, 2023; Johnson and Lee, 2023), blended learning (Anderson and Dron), and the use of Digital tools (Zou, Kuek, Feng, & Cheng) have improved student engagement and
performance (Acma and Ducot, 2024), but challenges like inadequate teacher training (Bernardo, 2019), limited resources (Patel, 2024; Martinez and Santos, 2024), and unequal access to technology remain significant barriers. Therefore, continuous research and innovation are essential to refine these strategies, ensure equitable implementation, and equip both teachers and learners with the competencies needed to succeed in an ever-evolving global society.

METHODOLOGY

2.1 General Database Search

A systematic search of electronic databases was conducted to identify empirical studies on 21st-century teaching and learning strategies. The search aimed to identify peer-reviewed empirical research (quantitative, qualitative, and mixed-methods) that explicitly investigated teaching and learning practices linked to 21st-century skills such as collaboration, critical thinking, creativity, digital literacy, and learner-centered instruction.

2.2 Identifying the Issue on 21st Century Teaching and Learning Strategies

The main issue arises from the fragmented and inconsistent empirical evidence on the effectiveness of 21st-century teaching and learning strategies. Studies vary in methodology, context, and outcome measures, making it difficult to generalize findings.

While techniques such as project-based (Johnson and Lee, 2023) learning, collaborative learning, and technology-enhanced instruction (Zou, Kuek, Feng, & Cheng, 2023) are widely promoted, empirical evidence on their impact on engagement, collaboration, and academic performance varies.

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
E-ISSN: 2672-2992
www.sajst.org

Additionally, many studies are limited by small sample sizes, self-reported measures, or a lack of longitudinal data. These limitations underscore the need for a systematic synthesis of research to provide clear guidance on which strategies effectively develop 21st-century competencies and under what conditions.

2.3 Recognizing the Solution for 21st Century Teaching and Learning Strategies

To address the identified issue, this review synthesizes empirical research to determine which 21st-century teaching strategies enhance student engagement, collaboration, and academic performance. Evidence suggests several promising solutions:

1. Collaborative Learning: Structured group work and peer-supported activities increase engagement and teamwork skills.
2. Project-Based and Inquiry-Based Learning: Authentic tasks and extended investigations promote critical thinking and problem-solving (Rehman, Huang, AlGerafi, & Javed, 2023), improving both engagement and academic outcomes (Johnson and Lee, 2023).
3. Technology-Enhanced Instruction: Digital tools and online platforms enable flexible, differentiated learning and support collaboration (Zou, Kuek, Feng, & Cheng, 2023).
4. Learner-Centered Approaches: Constructivist methods empower students, encourage autonomy, and facilitate higher-order thinking (Levin, Semenov, and Gorsky, 2021).

The solution lies in identifying which strategies are most effective, under what conditions, and for which learners, thereby providing actionable recommendations for educators and policymakers.

2.4 Identifying the Factors of 21st Century Teaching and Learning Strategies

Empirical evidence and literature review highlight several factors influencing the implementation of 21st-century strategies (Abadiano, 2023; Martinez and Santos, 2024; Patel, 2024):

1. Teacher Preparedness and Training: Insufficient professional development in digital pedagogy and modern instructional strategies
2. Resource Availability: Limited access to technology, digital tools, and learning materials (Patel, 2024)
3. Time and Workload Constraints: Planning and implementing innovative strategies require more time than traditional teaching
4. Assessment Challenges: Existing evaluation systems often fail to capture 21st-century competencies (Larson, 2024)
5. Resistance to Change: Teachers' preference for traditional methods can hinder adoption
6. Learner Diversity and Classroom Management: Varied abilities, behaviors, and language skills affect collaborative and technology-driven instruction
7. Administrative and Policy Support: Lack of institutional guidance or encouragement reduces sustainability (Patel, 2024)
8. Contextual and Cultural Factors: Educational norms, parental expectations, and examination-focused systems may limit innovation (Abadiano, 2023)

RESULTS AND DISCUSSION

3.1 General Database Search

The general database search yielded a comprehensive collection of scholarly literature that informed the results of this study. A systematic search was conducted across major academic platforms, including ERIC, Google Scholar, JSTOR, ScienceDirect, and SpringerLink. The search identified, screened, and analyzed studies in alignment with the research questions on 21st-century teaching and learning strategies. The initial search yielded a substantial number of studies, indicating ongoing academic interest in the topic. After applying the inclusion and exclusion criteria described in Chapter 2, only studies explicitly addressing the effectiveness, challenges, or recommended practices of 21st-century instructional approaches were retained. This refinement yielded a curated set of high-quality

sources that directly support the study's objectives. A thematic review of the selected literature revealed three dominant categories.

First, empirical evidence on effectiveness indicated that modern instructional strategies improved student engagement, collaboration, critical thinking, and digital literacy (Acma and Ducot, 2024; Stehle and PetersBurton, 2019).

Second, challenges and limitations included inadequate teacher training, limited technological resources (Patel, 2024), curriculum rigidity, and assessment misalignment (Larson, 2024), highlighting persistent barriers to implementation (Abadiano, 2023; Martinez and Santos, 2024).

Third, proposed solutions and recommendations focused on professional development (Mishra and Koehler, 2006), institutional support (Patel, 2024), technology investment (Zou, Kuek, Feng, & Cheng, 2023), and adoption of flexible, student-centered pedagogies (Katsara and De Witte, 2024).

Overall, the general database search provided a strong evidence base, revealing consistent patterns, highlighting gaps, and guiding the subsequent discussion of findings.

3.2 Issues and Challenges in Identifying 21st-Century Teaching and Learning Strategies.

The analysis of the reviewed literature revealed several issues and challenges that educators and institutions face in identifying and implementing 21st-century teaching strategies. One prominent challenge is inadequate teacher preparation and professional competence (Bernardo, 2019). Pre-service training and ongoing professional development often fail to adequately integrate technology (Mishra and Koehler, 2006), student-centered learning, and skills-based instruction, leading educators to rely on traditional methods.

Insufficient technological infrastructure and resources also hinder adoption (Patel, 2024). Schools with limited access to digital devices, reliable internet connectivity, and updated learning platforms face difficulties in implementing feasible strategies (Zou, Kuek, Feng, & Cheng, 2023). Curriculum rigidity (Smith) and assessment limitations (Larson, 2024) further restrict innovation, as content-heavy curricula and standardized testing leave little room for inquiry-based or collaborative activities.

Additionally, institutional barriers, including unclear guidance or insufficient leadership support, impede strategic implementation (Patel, 2024). Variations in student readiness, engagement, and digital skills present additional challenges, as teachers must adapt their strategies to meet diverse learning needs. The inherent complexity of 21st-century teaching, which integrates technology, active learning, higher-order thinking, and collaboration, adds to the challenge of implementing it coherently. Collectively, these issues underscore the multifaceted nature of adopting modern instructional strategies.

Table 1. Issues and Challenges in Identifying 21st-Century Teaching and Learning Strategies.

Issue / Challenge	Impact / Description
Teacher Preparation & Competence	Insufficient training in technology, student-centered learning, and skills-based instruction limits the adoption of modern strategies (Bernardo,2019; Mishra and Koehler, 2006).
Technological Infrastructure	Limited devices, internet, and platforms hinder implementation and create inequities (Patel, 2024).
Curriculum Rigidity	Content-heavy curricula and standardized testing hinder creativity and the integration of 21st-century skills (Smith, 2023).
Assessment Limitations	Traditional evaluations often fail to measure higher-order thinking, thereby failing to align with modern educational practices (Larson, 2024).
Institutional / Administrative Barriers	A lack of guidance and leadership support creates uncertainty about adopting a strategy (Patel, 2024).

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
E-ISSN: 2672-2992
www.sajst.org

Student Readiness & Diversity	Varied skills, motivation, and self-regulation lead to inconsistent effectiveness of strategies.
Complexity of 21st-Century Teaching	Integrating technology, collaboration, and critical thinking can be challenging for teachers without adequate support.

3.3 Identified Solutions for the Issues and Challenges on 21st-Century Teaching and Learning Strategies.

Several solutions emerged from the literature to address the identified challenges. Comprehensive and continuous professional development is essential for building teachers' competence in digital tools, collaborative learning, and student-centered instruction (Mishra and Koehler, 2006; Bernardo, 2019). Effective programs combine coaching, mentoring, classroom modeling, and hands-on experimentation in supportive environments.

Enhancing technological infrastructure and resource availability was frequently recommended. Investments in reliable internet connectivity, updated devices, and user-friendly platforms improve feasibility, while partnerships with governments or private organizations can address resource disparities (Patel, 2024). Curriculum flexibility and instructional redesign are also critical, enabling the integration of 21st-century skills through project- (Rehman, Huang, AlGerafi, & Javed, 2023), inquiry-, and interdisciplinary learning (Smith, 2023).

Strengthening administrative and institutional support ensures alignment and sustainability. Leadership initiatives, such as establishing professional learning communities, recognizing innovation, and allocating time for collaboration, foster systemic adoption (Patel, 2024). Student-related solutions include scaffolding digital literacy, promoting learner autonomy, and providing equitable support for diverse learners. Ultimately, modernizing assessment practices through performance tasks, portfolios, and peer evaluations more effectively captures higher-order thinking and 21st-century competencies (Larson, 2024). These solutions collectively emphasize the importance of systemic, well-coordinated efforts that support effective and sustainable implementation.

Table 2. For "Identified Solutions for the Issues and Challenges on 21st-Century Teaching and Learning Strategies"

Issues/ Challenges	Identified Solutions
Lack of teacher preparation and professional competence	Comprehensive and continuous professional development, including coaching, mentoring, classroom modeling, and opportunities to experiment with strategies (Bernardo, 2019; Mishra and Koehler, 2006)
Insufficient technological infrastructure and resources	Investment in reliable internet, updated digital devices, user-friendly platforms, and partnerships with the government and private sectors for resource acquisition (Patel; Zou, Kuek, Feng, & Cheng, 2023).
Rigid curriculum and instructional design	Curriculum flexibility and integration of 21st-century skills through project-based learning (Rehman, Huang, AlGerafi, & Javed, 2023), inquiry-based instruction, and interdisciplinary activities (Smith, 2023)
Weak administrative and institutional support	Strong leadership involvement, clear vision and guidance, professional learning communities, recognition of teacher innovation, and allocation of planning/collaboration time (Patel, 2024)
Variations in student readiness and engagement	Scaffolded activities to develop digital literacy, learner autonomy, and equitable participation in collaborative, technology-rich learning environments
Traditional assessment methods	Adoption of alternative assessments such as portfolios, performance tasks, digital presentations, and peer evaluations to capture higher order thinking and real-world problem-solving skills (Larson, 2024)

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
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www.sajst.org

3.4 Recognizing the Factors That Remain Challenges Affecting 21st-Century Teaching and Learning Strategies.

Despite these solutions, several underlying factors continue to impede full adoption of 21st-century teaching strategies. Uneven teacher (Bernardo, 2019) readiness, resource inequality (Patel, 2024), structural rigidity (Smith, 2023), inconsistent leadership support, student variability, and traditional assessment frameworks (Larson, 2024) persist as barriers (Martinez and Santos, 2006). Variations in training, digital literacy, and pedagogical confidence create gaps in instructional quality. Resource disparities, particularly in underserved communities, limit access to technology and infrastructure, constraining implementation (Patel, 2024).

Structural constraints, including standardized curricula, fixed schedules, and high-stakes testing, reduce opportunities for creative and inquiry-based learning (Smith, 2023). Leadership inconsistency undermines systemic support (Patel, 2024), while student-related factors, including motivation and digital competence, influence engagement. Reliance on traditional assessment methods misaligns evaluation with modern instructional goals (Larson, 2024). Addressing these persistent challenges requires long-term, coordinated strategies at the teacher, school, and policy levels to achieve meaningful transformation in education.

CONCLUSION

The review demonstrates that 21st-century teaching and learning strategies significantly enhance student outcomes when effectively implemented (Acma and Ducot, 2024). However, widespread adoption remains hindered by teacher preparation gaps, (Bernardo, 2019) technological limitations (Patel, 2024), rigid curricula (Smith), and misaligned assessment systems (Larson, 2024). Addressing these challenges requires sustained professional development, stronger institutional support, investment in technological infrastructure, and reformed assessment practices. Ultimately, a coordinated effort among teachers, institutions, and policymakers is essential to integrate 21st-century pedagogies into educational systems fully.

FUTURE WORK

Building on the findings of this study, several directions for future research and practical development are recommended to further enhance 21st-century teaching and learning strategies.

First, empirical classroom-based studies—such as case studies, action research, or experimental designs—are needed to measure the real-time impact of these strategies on diverse student populations.

Second, exploring student perspectives can provide valuable insights into learners' experiences, preferences, and support needs in technology-rich, collaborative environments.

Third, further investigation into professional development models is essential to identify the most effective approaches, including mentoring, coaching, workshops, or blended training, for building teacher capacity in modern instructional practices (Mishra and Koehler, 2006; Bernardo, 2019).

Fourth, research on policy frameworks and leadership roles can reveal how institutional culture, administrative support, and educational policies influence the adoption and sustainability of innovative strategies (Patel, 2024).

Fifth, developing and refining assessment frameworks that accurately measure 21st-century competencies—such as creativity, Collaboration, critical thinking, and digital literacy—is crucial to align evaluation with instructional goals (Larson, 2024).

Finally, addressing equity in access to technology remains a vital area, particularly for underserved or rural schools, to ensure that all students benefit from modern pedagogical approaches. Pursuing these areas will strengthen the knowledge base and guide effective implementation of 21st-century teaching and learning strategies.

Volume 10, Issue 1, 2025
P-ISSN: 2672-2984
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