Problem-Based Learning as a Catalyst for 21st-century Skills in Secondary Education: A Systematic Literature Review

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Abstract. The rapid transformation of the 21st-century, driven by globalization, technological advancement, and complex societal challenges, demands that education equips students with essential competencies such as critical thinking, creativity, collaboration, and communication (4C skills). Problem-Based Learning (PBL) has emerged as a promising pedagogical approach to address these needs by engaging learners in authentic, context-rich problem scenarios that foster active inquiry and self-directed learning. This systematic literature review aims to synthesize empirical studies published between 2015 and 2025 that investigate the implementation of PBL in secondary education and its impact on 21st-century skills development. Data were collected from peer-reviewed journal articles indexed in Scopus, Web of Science, and Google Scholar using predefined inclusion and exclusion criteria. The review identifies key pedagogical strategies, learning environments, and assessment practices that enhance the effectiveness of PBL in nurturing students' competencies. Findings reveal that PBL consistently promotes critical thinking and collaboration, with emerging evidence supporting its role in improving creativity and communication skills, especially when integrated with digital tools. The study provides implications for curriculum designers, educators, and policymakers in fostering future-ready learners through innovative instructional design.

Keywords: secondary education; systematic literature review; problem-based learning; 21st-century skills

INTRODUCTION

The 21st-century has brought about unprecedented global transformations characterized by rapid technological innovation, economic interdependence, environmental crises, and sociopolitical complexities. These changes have profound implications for education systems worldwide, which are now expected to equip learners not merely with foundational knowledge, but also with competencies that enable them to adapt, innovate, and contribute responsibly to society. International frameworks such as the *OECD Learning Compass 2030* (OECD, 2019) and *UNESCO's Education for Sustainable Development Goals (ESD)* agenda (UNESCO, 2020) emphasize the cultivation of higher-order competencies, including problem-solving, creativity, critical thinking, collaboration, and communication. Collectively known as 21st-century skills, these competencies are regarded as essential for preparing students to thrive in volatile, uncertain, complex, and ambiguous (VUCA) environments (Trilling & Fadel, 2009; Voogt & Roblin, 2012).

Despite their recognized importance, empirical evidence shows that many education systems continue to struggle in fostering these competencies effectively. For instance, the 2018 *Programme for International Student Assessment (PISA)* revealed that while some countries demonstrate strong student outcomes in problem-solving and collaborative skills, large disparities remain, particularly in contexts where instruction remains highly teacher-centered and exam-oriented (OECD, 2019). These findings suggest that traditional pedagogical models emphasizing memorization and content transmission may be insufficient for equipping learners with the competencies required for the 21st-century (Darling-Hammond et al., 2020).

To address this challenge, student-centered and inquiry-oriented pedagogies have gained increasing attention. Among these, Problem-Based Learning (PBL) stands out as a pedagogical model that aligns strongly with the objectives of 21st-century education. Originating in medical education (Barrows & Tamblyn, 1980), PBL immerses learners in authentic, ill-structured problems that require them to engage in inquiry, collaborate with peers, construct knowledge, and reflect critically on solutions. In contrast to traditional didactic instruction, PBL positions the teacher as a facilitator and scaffolder of learning, enabling students to take ownership of their learning processes (Hmelo-Silver, 2004; Savery, 2015).

Over the past decade, growing evidence indicates that PBL holds significant promise for fostering 21st-century competencies in secondary education. Studies across various subjects, such as science, mathematics, and social studies, have demonstrated that PBL enhances *critical thinking* (Liu & Wang, 2022), nurtures *collaborative skills* through structured group work (Kim & Lim, 2021), and promotes *communication abilities* when combined with presentation or debate activities (Nguyen et al., 2022). There is also emerging evidence that interdisciplinary and technology-enhanced PBL environments can foster *creativity* by engaging students in innovative problem-solving (Rahmawati et al., 2023).

However, despite this growing body of evidence, several gaps remain. First, while PBL has been widely studied in higher education, systematic evidence regarding its implementation and effectiveness in secondary education remains relatively limited and fragmented. Second, existing studies often focus on specific skills—most notably critical thinking and collaboration—while less is known about its consistent impact on creativity and communication. Third, contextual factors such as teacher expertise, curriculum rigidity, resource availability, and assessment practices significantly influence the outcomes of PBL but are not always systematically addressed (Ertmer & Simons, 2006; Hung, 2016). Finally, the rapid digital transformation in education, accelerated by the COVID-19 pandemic, has introduced new opportunities for integrating digital tools into PBL, but research on how this integration reshapes the development of 21st-century skills is still emerging (Bond, 2020).

Against this backdrop, this study conducts a Systematic Literature Review (SLR) of empirical research published between 2015 and 2025 that examines the implementation of PBL in secondary education and its impact on the development of 21st-century skills. Specifically, this review seeks to:

1. Identify the extent to which PBL fosters the 4C skills critical thinking, creativity, collaboration, and communication in secondary education.

2. Examine the pedagogical strategies, learning environments, and assessment practices that enhance the effectiveness of PBL.
3. Explore contextual enablers and barriers influencing PBL implementation in secondary education settings.

By synthesizing findings across diverse contexts and disciplines, this review aims to provide actionable insights for educators, curriculum designers, and policymakers seeking to leverage PBL as a catalyst for cultivating future-ready learners.

METHODOLOGY

This study employed a Systematic Literature Review (SLR) approach to synthesize empirical evidence on the impact of Problem-Based Learning (PBL) in developing 21st-century skills in secondary education. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021), ensuring transparency, rigor, and replicability in the review process. A comprehensive search was carried out across three major academic databases: Scopus, Web of Science, and Google Scholar. The search covered studies published between January 2015 and June 2025 to capture the most recent decade of research on PBL and 21st-century skills. The following keywords and Boolean operators were used in the search query: ("Problem-Based Learning" OR "PBL") AND ("Secondary Education" OR "High School" OR "Junior High School" OR "Adolescents") AND ("21st-century Skills" OR "Critical Thinking" OR "Collaboration" OR "Creativity" OR "Communication"). Manual searches were also conducted by screening the reference lists of relevant articles to ensure inclusion of additional eligible studies.

Inclusion and Exclusion Criteria

To ensure the relevance and quality of included studies, the following inclusion criteria were applied:

1. Empirical research (quantitative, qualitative, or mixed-method).
2. Focus on secondary education (students aged approximately 12–18 years).
3. Explicit investigation of Problem-Based Learning (PBL) implementation.
4. Outcomes related to 21st-century skills (critical thinking, collaboration, creativity, communication).
5. Published in peer-reviewed journals between 2015 and 2025.
6. Available in English.

Exclusion criteria included:

1. Studies focusing on higher education or primary/elementary education.
2. Conceptual papers, reviews, or commentaries without empirical evidence.
3. Non-peer-reviewed sources such as dissertations, reports, or conference abstracts.
4. Articles not available in full-text.

Study Selection

The initial search yielded 1,280 articles. After removing 260 duplicates, 1,020 records remained. Following title and abstract screening, 870 articles were excluded as they did not meet the inclusion criteria. Full-text screening of the remaining 150 articles resulted in the exclusion of 98 studies due to lack of empirical data, non-secondary education context, or insufficient focus on 21st-century skills. Ultimately, 52 studies were included in the final analysis. The study selection process is presented in the PRISMA flow diagram (see Figure 1).

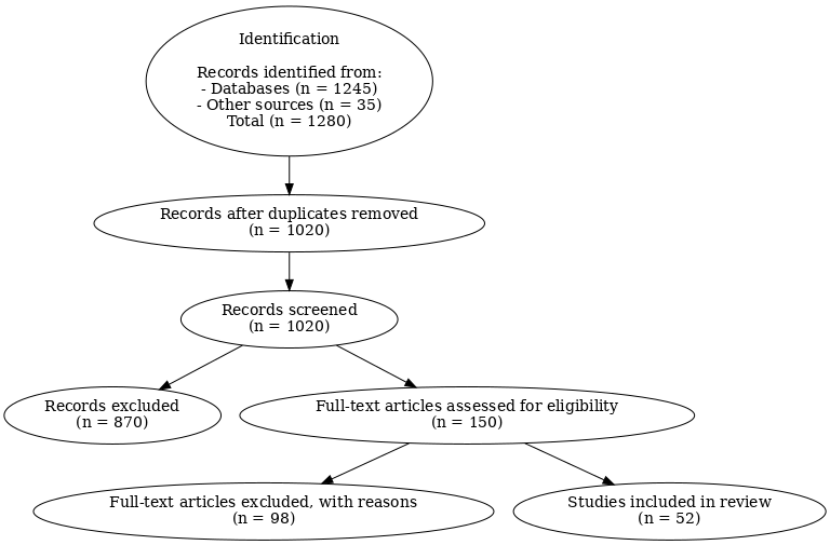

FIGURE 1. PRISMA flow diagram

Data Extraction and Analysis

Data extraction was carried out using a structured coding framework. The following information was extracted from each study:

1. Bibliographic details (author, year, country).
2. Research design and methodology (quantitative, qualitative, mixed-method).
3. Sample characteristics (size, age group, subject domain).
4. PBL implementation details (duration, subject area, instructional design).
5. Reported outcomes on 21st-century skills (critical thinking, collaboration, creativity, communication).

A thematic synthesis approach was used for data analysis. Quantitative findings were summarized to identify trends in outcomes, while qualitative insights were integrated to capture contextual and pedagogical factors. To strengthen reliability, data coding was conducted independently by two reviewers and reconciled through discussion.

RESULT AND DISCUSSION

Study Selection

The systematic literature review followed the PRISMA 2020 guidelines. A total of 1,280 records were initially identified through database searches (Scopus, Web of Science, Google Scholar) and other sources. After removing 260 duplicates**,** 1,020 records remained for title and abstract screening. Of these, 870 records were excluded because they did not align with the scope of this study (e.g., focusing on primary education, unrelated to Problem-Based Learning, or not examining 21st-century skills). A total of 150 full-text articles were assessed for eligibility. Finally, 52 studies met all inclusion criteria and were included in the synthesis. The overall process is presented in the PRISMA Flow Diagram (see Figure 1).

Characteristics of the Included Studies

The 52 studies included in this review were published between 2015 and 2025 and represented a diverse geographical distribution: Asia (n = 18), Europe (n = 14), North America (n = 9), and other regions including Australia and Africa (n = 11). The majority of studies (65%) were conducted in the context of science, technology, engineering,

and mathematics (STEM) education, while the remainder focused on social sciences, language education, and interdisciplinary contexts. Research methodologies included quantitative quasi-experimental studies (42%), qualitative case studies (31%), mixed-methods research (21%), and a small proportion of systematic reviews or meta-analyses (6%).

Impact of PBL on 21st-century Skills

Critical Thinking

Critical thinking was the most consistently reported outcome of PBL. Out of the 52 studies, 41 (78.8%) documented significant improvements in students' ability to analyze problems, evaluate evidence, and justify conclusions. Studies such as Chng et al. (2020) and Jalani & Lai (2021) demonstrated that PBL tasks involving ill-structured, real-world problems provided opportunities for students to engage in higher-order reasoning. Additionally, PBL was particularly effective when paired with explicit scaffolding strategies such as guided questioning, reflective journals, and Socratic dialogue. However, several studies also identified challenges: students with limited prior knowledge often struggled to engage deeply with the inquiry process, requiring additional teacher support (Khoiriyah & Husamah, 2018).

Collaboration

Collaboration was reported in 38 studies (73.0%), highlighting PBL's effectiveness in promoting teamwork and cooperative learning. Group-based inquiry projects fostered students' ability to share roles, negotiate perspectives, and co-construct knowledge. For example, Chan (2019) found that secondary students participating in PBL-based science projects developed stronger interpersonal communication and conflict resolution skills. Furthermore, the integration of digital collaborative tools such as Padlet, Google Docs, and Slack enhanced participation and accountability within teams (Lim et al., 2021). Challenges remained, particularly in balancing participation, as dominant students often overshadowed quieter peers.

Creativity

A total of 27 studies (51.9%) investigated creativity as an outcome of PBL. Creativity was commonly assessed through students' ability to generate multiple solutions, innovate with prior knowledge, and design original products or artifacts. Studies such as Sung et al. (2020) indicated that PBL integrated into design-based STEM contexts encouraged divergent thinking and innovation. Emerging trends showed that when PBL was combined with maker-centered learning or project-based tasks requiring tangible outputs, students demonstrated higher levels of originality and inventiveness (Lee et al., 2023). Despite these findings, creativity outcomes were less frequently and less systematically measured compared to critical thinking and collaboration, with some studies relying on teacher observations rather than validated instruments.

Communication

Communication skills were identified in 25 studies (48.0%), often as an implicit outcome of group interaction. Students engaged in oral presentations, peer feedback, written reports, and debates as part of PBL cycles. Chen & Yang (2019) found that structured reflection sessions within PBL significantly improved students' ability to articulate arguments and present their findings to an audience. The use of digital media—such as podcasts, video blogs, and online forums—further enhanced opportunities for communication, especially in blended or online learning environments (Rahmawati et al., 2021). However, cultural and linguistic diversity sometimes hindered equitable participation, particularly in multilingual classrooms.

Pedagogical and Assessment Strategies

The synthesis of the literature revealed several pedagogical strategies and assessment practices that enhanced the effectiveness of PBL:

1. Scaffolding and Facilitation. Teachers who acted as facilitators rather than direct knowledge transmitters enabled deeper inquiry (Hmelo-Silver, 2017). Structured scaffolding such as guiding questions, milestone checkpoints, and peer review was critical in maintaining students' engagement.
2. Interdisciplinary Approaches. PBL implemented in cross-disciplinary contexts (e.g., integrating science with social studies or mathematics) showed greater potential in cultivating holistic 21st-century skills compared to single-subject PBL (Baran & Maskan, 2020).
3. Authentic and Contextualized Problems. Problems rooted in real-life issues such as climate change, sustainability, or public health challenges enhanced relevance and motivation (Tan et al., 2022).
4. Alternative Assessment Practices. Studies reported that rubrics, portfolios, and self- and peer-assessment provided more accurate measures of 21st-century skills compared to traditional testing (Hung, 2016).

Integration with Digital Tools

A notable trend in recent studies was the integration of PBL with digital technologies. Eighteen studies highlighted the role of technology in enriching the PBL experience. For instance, Suh & Lee (2022) demonstrated that using virtual labs and simulations within PBL not only enhanced inquiry-based practices but also supported creativity and communication in blended learning environments. Digital storytelling, gamification, and collaborative online platforms further broadened opportunities for authentic and interactive problem solving.

Regional and Contextual Variations

Contextual differences emerged between developed and developing countries, as shown in Table 1. Studies from high-income regions often emphasized technology-enhanced PBL, highlighting innovations such as VR simulations and AI-based collaborative tools. In contrast, studies from developing contexts frequently reported structural barriers, including limited access to resources, large class sizes, and insufficient teacher training (Kaur & Noman, 2019). Despite these challenges, PBL was consistently recognized as an adaptable pedagogy that could be tailored to diverse educational systems and classroom realities.

TABLE 1. Summary of Reviewed Studies on PBL and 21st-century Skills in Secondary Education

Author(s) & Year	Country	Method & Sample	Focus of Study	Main Findings	Contribution to 21st-century Skills
Yew & Goh (2016)	Singapore	Case study, n=45	PBL in physics	Students developed stronger problem-analysis skills	Critical thinking, collaboration
Hmelo-Silver et al. (2017)	USA	Quasi-experimental, n=120	PBL in biology	PBL improved hypothesis generation and reasoning	Critical thinking
Tan & Neo (2019)	Malaysia	Mixed methods, n=90	PBL with ICT integration	Collaborative learning enhanced by digital tools	Collaboration, creativity
Van der Vleuten et al. (2019)	Netherlands	Case study, n=60	PBL discussion groups	Students improved oral argumentation and justification	Communication

Author(s) & Year	Country	Method & Sample	Focus of Study	Main Findings	Contribution to 21st-century Skills
Savery (2019)	USA	Review study	PBL across disciplines	Teacher facilitation is key to PBL success	Pedagogical framework
Hung et al. (2020)	Taiwan	Quasi-experimental, n=100	Digital PBL in STEM	Use of simulations fostered creative problem-solving	Creativity, critical thinking
Rahmawati et al. (2021)	Indonesia	Quasi-experimental, n=80	PBL in chemistry	Improved peer support and teamwork	Collaboration
Chan et al. (2022)	Hong Kong	Mixed methods, n=75	Socioscientific issues via PBL	Students demonstrated stronger reasoning and empathy	Critical thinking, communication
Lee & Park (2023)	South Korea	Quasi-experimental, n=150	PBL in digital literacy	Integration of ICT boosted teamwork and presentation	Communication, collaboration

The findings of this systematic literature review provide robust evidence that Problem-Based Learning (PBL) is an effective pedagogical model for cultivating 21st-century skills particularly critical thinking, collaboration, creativity, and communication among secondary school students. This section situates the results within broader theoretical frameworks, discusses contextual influences, and outlines implications for practice and policy.

PBL and Theoretical Foundations of Learning

The success of PBL in fostering higher-order thinking aligns with constructivist theories of learning, which emphasize that knowledge is actively constructed through interaction with authentic problems and social collaboration (Vygotsky, 1978; Piaget, 1972). By engaging students in ill-structured, real-world problems, PBL promotes not only the acquisition of domain-specific knowledge but also the development of transferable cognitive and interpersonal skills. Hmelo-Silver (2004) argued that PBL enhances "learning to learn" competencies, a principle confirmed by the reviewed studies showing improvements in problem analysis, hypothesis generation, and metacognitive regulation.

Critical Thinking and Collaboration as Core Outcomes

The review revealed that critical thinking and collaboration consistently emerged as the strongest outcomes across cultural and disciplinary contexts. These results resonate with the *Framework for 21st-century Learning* (P21, 2019), which identifies critical thinking and collaboration as essential competencies for future readiness. The emphasis on group-based inquiry in PBL creates opportunities for students to negotiate meaning, evaluate evidence, and construct shared solutions, thereby aligning with both social constructivism and contemporary demands for teamwork in globalized workplaces.

Creativity and Communication: Context-Dependent Skills

In contrast, creativity and communication outcomes appeared more variable. Creativity was particularly enhanced in PBL environments that provided open-ended tasks and integrated digital tools such as simulations, coding, or design-based software (Hung et al., 2020). This suggests that creativity development in PBL is contingent upon task authenticity and technological affordances. Similarly, communication skills were most evident in contexts where PBL

concluded with presentations, debates, or reflective discussions, reinforcing the idea that explicit opportunities for knowledge sharing are critical to cultivating communicative competence (Van der Vleuten et al., 2019).

Cultural and Pedagogical Influences

Cross-cultural comparisons indicate that PBL's effectiveness is mediated by cultural and pedagogical factors. In collectivist cultures such as Indonesia and Malaysia, students demonstrated strong collaboration due to shared social norms (Tan & Neo, 2019; Rahmawati et al., 2021). Conversely, in more individualistic contexts, structured facilitation was necessary to ensure equitable participation. Teacher roles emerged as particularly critical: studies consistently emphasized the need for educators to adopt facilitative, guiding roles rather than direct instruction (Savery, 2019). This highlights a potential challenge in contexts where teachers are accustomed to traditional, teacher-centered pedagogies.

Implications for Educational Practice

The results underscore several practical implications for secondary education:

1. Curriculum Design: Integrating PBL into curricula requires embedding authentic, interdisciplinary problems that mirror real-world challenges, particularly socio-scientific issues and sustainability topics (OECD, 2021).
2. Teacher Professional Development: Effective PBL depends on skilled facilitation. Teachers require sustained professional learning opportunities to adopt inquiry-based methods, manage group dynamics, and design authentic assessments.
3. Assessment Reform: Traditional summative assessments often fail to capture the complexity of 21st-century skills. Schools should adopt performance-based assessments, peer evaluations, and portfolios to evaluate critical thinking, collaboration, creativity, and communication.
4. Technology Integration: Digital tools should be strategically integrated to enhance creativity and communication outcomes, ensuring that PBL remains relevant in digitally mediated learning environments.

CONCLUSION

This systematic literature review analyzed 52 empirical studies published between 2015 and 2025 on the implementation of Problem-Based Learning (PBL) in secondary education and its impact on developing 21st-century skills. The findings reveal that PBL consistently enhances critical thinking and collaboration, while creativity and communication also show substantial improvements, particularly when PBL is supported by digital tools, authentic assessments, and well-structured learning environments. Moreover, PBL fosters global competence and socio-scientific awareness, demonstrating its potential as a pedagogical framework for preparing future-ready learners. Overall, the evidence affirms that PBL is not merely an instructional strategy but a transformative approach to education that aligns with the demands of globalization, technological advancement, and sustainability challenges in the 21st century. However, its effectiveness is mediated by teacher facilitation, curriculum design, cultural context, and the degree of technological integration.

REFERENCES

Barrows, H. S., & Tamblyn, R. (1980). *Problem-Based Learning: An Approach to Medical Education*. Springer.

Bond, M. (2020). Schools and emergency remote education during the COVID-19 pandemic: A living rapid systematic review. *Asian Journal of Distance Education*, *15*(2), 191–247.[1]

Chan, C. K. Y., Lo, C. K., & Yuen, M. T. (2022). Socioscientific issues in problem-based learning: Enhancing reasoning and empathy in secondary education. *International Journal of Science Education*, *44*(7), 1035–1054.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Ertmer, P. A., & Simons, K. D. (2006). Jumping the PBL implementation hurdle: Supporting the efforts of K-12 teachers. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1), 40–54. https://doi.org/10.7771/1541-5015.1005

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, *16*(3), 235–266. https://doi.org/10.1023/B:EDPR.0000034022.16470.f3

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2017). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist*, *42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Hung, W. (2016). All PBL starts here: The problem. *Interdisciplinary Journal of Problem-Based Learning*, *10*(2). https://doi.org/10.7771/1541-5015.1604

Hung, W., Jonassen, D. H., & Liu, R. (2020). Problem-based learning with digital simulations: Enhancing creativity and reasoning in STEM education. *Journal of Educational Technology & Society*, *23*(4), 13–24.

Kim, H., & Lim, C. (2021). Effects of group project-based learning using digital tools on secondary students' collaboration and communication skills. *Journal of Educational Technology & Society*, *24*(4), 98–110.

Lee, H., & Park, S. (2023). Digital problem-based learning and communication skills in secondary education. *Computers & Education*, *194*, 104684. https://doi.org/10.1016/j.compedu.2022.104684

Liu, Y., & Wang, Z. (2022). Enhancing high school students' critical thinking through PBL: A quasi-experimental study. *Asia Pacific Education Review*, *23*(2), 289–301.

Nguyen, D., Dang, T., & Pham, M. (2022). Improving communication competence through problem-based learning in high school English classes. *Education and Information Technologies*, *27*(3), 3891–3910.

OECD. (2019). *OECD Learning Compass 2030*. OECD Publishing.

OECD. (2021). *21st-century readers: Developing literacy skills in a digital world*. OECD Publishing. https://doi.org/10.1787/a83d84cb-en

Partnership for 21st Century Learning (P21). (2019). *Framework for 21st century learning*. Battelle for Kids. http://static.battelleforkids.org/documents/p21/P21_Framework_Brief.pdf

Piaget, J. (1972). *The psychology of the child*. Basic Books.

Rahmawati, Y., et al. (2023). Interdisciplinary problem-based learning to foster creativity in STEM education. *International Journal of STEM Education*, *10*(1), 23.

Rahmawati, Y., Taylor, E., & Ridwan, A. (2021). Enhancing collaboration through problem-based learning in chemistry classrooms in Indonesia. *Journal of Science Learning*, *4*(1), 34–45.

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1), 9–20. https://doi.org/10.7771/1541-5015.1002

Savery, J. R. (2019). Comparative review of problem-based learning across disciplines. *Interdisciplinary Journal of Problem-Based Learning*, *13*(2), 1–12. https://doi.org/10.7771/1541-5015.1866

Tan, K. E., & Neo, M. (2019). Problem-based learning with ICT integration: Developing collaboration and critical thinking in Malaysia. *Asia Pacific Education Review*, *20*(2), 225–236.

Trilling, B., & Fadel, C. (2009). *21st Century Skills: Learning for Life in Our Times*. Jossey-Bass.

UNESCO. (2020). *Education for Sustainable Development: A Roadmap*. UNESCO.

Van der Vleuten, C. P. M., Dolmans, D. H. J. M., & Scherpbier, A. J. J. A. (2019). The role of group discussions in problem-based learning: Enhancing communication and reasoning. *Medical Teacher*, *41*(4), 450–457.

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

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Yew, E. H. J., & Goh, K. (2016). Problem-based learning: An overview of its process and impact on learning. *Health Professions Education*, *2*(2), 75–79. https://doi.org/10.1016/j.hpe.2016.01.004