Designing Professional Development Workshop to Foster Critical Thinking Skills in Hybrid Learning Environments in Higher Education

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Abstract— **In an era increasingly shaped by Hybrid Learning (HL) and Artificial Intelligence (AI), equipping pre-service teachers with strong Critical Thinking Skills (CTS) is imperative for effective teaching and lifelong learning. This study presents the design and implementation of a research-based Professional Development (PD) workshop aimed at fostering CTS among pre-service teachers in Hybrid Learning (HL) environments. Grounded in Merrill's First Principles of Instruction and Paul and Elder's Intellectual Standards, the workshop integrates innovative Pedagogical strategies such as, Evidence-Based Learning (EBL), Socratic Questioning (SQ), Game-Based Learning (GBL), Discussion-Based Learning (DBL) and scenario-driven group tasks to promote reflective and analytical thinking. The study employs a qualitative case study methodology, drawing on data from document analysis, semi-structured interviews, and pre-/post-surveys to investigate how teacher candidates and instructors perceive and apply CTS strategies in hybrid contexts. The findings indicate that targeted, interactive PD experiences can enhance pre-service teachers' ability to engage in and facilitate Critical Thinking (CT) in hybrid settings. The paper offers practical implications for instructional designers, teacher educators, and policymakers seeking to support CTS development in the digital age.**

Keywords - critical thinking skills; hybrid learning; pre-service teachers; instructional design; professional development

I. INTRODUCTION

The creation of Professional Development (PD) workshops aimed at enhancing CTS among pre-service teachers within HL environments in higher education is a multifaceted endeavor that requires careful consideration of pedagogical strategies, theoretical frameworks, and the integration of technology. The introduction of advanced tools such as ChatGPT has significantly transformed educational paradigms, enabling personalized learning experiences that cater to individual student needs. This shift underscores the importance of equipping future educators with the ability to critically analyze and adapt their teaching methods to diverse contexts [1]. CT is often defined through cognitive skills and affective dispositions, emphasizing its role as both a generic and domain-specific ability. The transferability of CT across different domains remains a subject of debate, but its presence in science education and other fields highlights its universal applicability. Background knowledge plays a crucial role in fostering CT, as it provides the foundation upon which analytical and reflective thinking can be built [2]. In HL environments, where traditional face-to-face instruction is combined with online modalities, the cultivation of CT becomes even more essential. These settings demand innovative approaches that not only engage students but also challenge them to think independently and critically. Effective teaching strategies for promoting CT include mentoring, authentic problem-solving tasks, dialogue-based methods, and inquiry-driven practices. These approaches encourage educators to evaluate their instructional techniques critically and adapt them to meet the needs of diverse learners. Research has demonstrated that these strategies are effective in enhancing cognitive abilities beyond conventional methods. For instance, mentoring allows pre-service teachers to gain insights into real-world challenges while fostering reflective thinking. Similarly, inquiry-based teaching creates an environment where educators and students collaboratively explore complex issues, thereby nurturing critical analysis. The integration of technology into professional development programs further supports the development of CT skills. Tools like ChatGPT exemplify how artificial intelligence can be leveraged to provide tailored educational experiences. By analyzing individual strengths and weaknesses, these technologies enable pre-service teachers to refine their instructional strategies and address specific learning objectives effectively. Moreover, online discussions facilitated by HL platforms have been shown to enhance students' ability to organize ideas coherently, develop thesis statements, and integrate content across various sections of their work. These discussions serve as a medium for meaningful exchanges that promote critical engagement with subject matter. Professional development workshops designed for pre-service teachers must also consider the audience's prior knowledge, interest in the topic, and stance toward the subject matter. By aligning workshop objectives with these factors - such as informing participants about effective practices or persuading them to adopt new methodologies - educators can better prepare future teachers for the complexities of modern classrooms [3]. Additionally, focusing on content goals like writing argumentative essays or engaging in independent text discussions helps students develop self-sponsored questions about texts and improve their analytical capabilities. The authors emphasize that systemic development in education requires both individual growth among educators and structural changes within institutions. This dual approach ensures that PD programs are not only grounded in research but also adaptable to evolving educational landscapes [4]. HL environments offer

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unique opportunities for this systemic growth by combining traditional pedagogical methods with innovative technological solutions. By fostering CTS through targeted PD workshops, higher education institutions can prepare pre-service teachers to navigate diverse learning contexts effectively. These efforts contribute to creating a generation of educators who are equipped with the skills necessary for reflective practice and adaptive teaching strategies [5] [6].

The main objective of this study is to examine the instructional strategies and models—including Merrill's Principles and Paul and Elder's Standards—that teaching assistants (TAs) employ to foster CTS in HL environments. Additionally, the study investigates how these strategies influence the development of CTS in pre-service teachers, as well as the challenges that both TAs and students encounter in implementing them effectively.

To guide this inquiry, the study addresses the following research questions. First, how do TAs integrate CTS into the delivery of HL courses in higher education? Second, what strategies do TAs and pre-service teachers perceive as most effective or challenging in fostering CTS within HL environments?

The rest of the paper is structured as follows: Section II reviews related work on CTS and professional development in hybrid environments. Section III outlines the instructional framework combining Merrill's and Paul and Elder's models. Section IV presents the methodology. Section V discusses key findings and implications. Section VI concludes with directions for future research.

II. LITERATURE REVIEW

CT is an essential skill for students in the 21st century, enabling them to analyze information, solve problems, and make informed decisions. CTS encompass the mental processes of discernment, analysis, and evaluation to achieve a logical understanding [7]. It has become even more important that students are taught to think critically, which means it can be facilitated during teaching and learning [8]. It has been suggested that CT should be integrated into pedagogical practices [9]. It is also an important skill that every student needs to have, including elementary students [10]. Therefore, teachers must possess a solid understanding of CT principles and effective strategies for fostering these skills in their students [11].

Effective teaching methods are important for teaching students CTS. One method is to facilitate problem-solving skills in educational settings using Socratic inquiry [12]. This method encourages students to think for themselves and value their own questions [13]. Socratic seminars are one way to promote CT and values clarification [14]. Instructors should ask open-ended questions rather than ones with simple answers [15]. Educators may foster independent and higher-level thought in their pupils by using SQ, which gives them ownership of their learning through conversation, debate, assessment, and material analysis [16].

Moreover, HL environments, which blend face-to-face and online instruction, present unique opportunities and challenges for promoting CT. This method of teaching can create more independent and critical thinkers [17]. Teachers that have the ability to successfully integrate technology can have students be more engaged in the classroom and have the potential to be critical thinkers. However, students' thinking abilities are not always systematically developed because teachers' instructional delivery frequently emphasizes the mastery of concepts or theories [18]. Therefore, teachers require PD opportunities that equip them with the knowledge and skills necessary to design and implement effective instruction that fosters CT in HL environments.

Teachers' beliefs and thought processes greatly affect how well students perform in school and what they accomplish [19]. If teachers are given the proper support and tools, they can have a substantial impact on the growth of students' critical thinking abilities. Schools are responsible for improving students' CTS [20]. Therefore, teachers must have the skills to teach these students in ways that will cause them to think critically and creatively.

PD is often aimed at enhancing student success by increasing teachers' knowledge of the subject matter and improving their teaching methods [21]. Effective PD is essential to help teachers learn and improve the pedagogies needed to teach these skills. Many PD programs, however, seem ineffective in encouraging changes in teachers' practices and student learning [22]. Most existing PD programs tend to be short, lack well-designed structures, and do not seem to provide participants with opportunities to experience Blended Learning (BL) themselves [23]. PD workshop is seen as a crucial way to help teachers improve their skills, knowledge, and effectiveness, leading to a shift from traditional workshops to comprehensive strategies that build teacher capacity in subject matter, pedagogy, and understanding student thinking [24]. PD should provide teachers with chances to use what they're learning in their own teaching and solve problems they encounter in their classrooms [25]. The design of successful PD activities should include follow-up support, active learning opportunities, and the chance for teachers to work together [26]. Designing PD workshop is not about changing teachers' attitudes towards integrating technology or improving their skills with specific technologies [27]. Rather, it involves understanding the nature of technology integration and providing teachers with opportunities to develop the knowledge, skills, and attitudes needed to integrate technology into their teaching [28] [29]. The emphasis should be placed on ensuring that PD workshop is linked to identified teacher needs and that teachers have a say in the type of learning they require to best support their students [22].

Research on CTS in higher education has grown significantly, particularly in response to the shift toward hybrid and online learning environments. Many studies affirm the value of instructional strategies such as SQ, Problem-Based Learning (PBL), and DBL in cultivating CTS across disciplines. Scholars have also emphasized the importance of integrating digital tools and AI technologies into Instructional Design (ID) to enhance learner engagement and Higher-Order Thinking (HOT). However, most of this research remains focused on traditional classroom settings,

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with relatively few studies addressing CTS development in hybrid environments, especially within pre-service teacher education programs in the U.S. context.

Despite these contributions, several important questions remain unanswered. For instance, there is limited understanding of how pre-service teachers apply CTS-promoting strategies in real-world hybrid classrooms. It is also unclear how instructional models such as Merrill's First Principles or Paul and Elder's Intellectual Standards translate into effective, scalable workshop designs for diverse learner populations. Moreover, few studies have examined how artificial intelligence tools like ChatGPT or adaptive learning platforms can be leveraged to scaffold CTS development among pre-service teachers. These gaps underscore the need to explore not only which instructional strategies work, but also why, how, and under what conditions they are most effective.

The literature reveals a wish list for future research that includes deeper exploration of technology-mediated strategies tailored to hybrid settings, especially those integrating AI and digital feedback tools. There is also a need for empirical studies that examine the long-term impact of PD on CTS, beyond initial knowledge gains. Specifically, the field lacks research on the sustainability of CTS-promoting instructional changes and their transferability across different educational contexts. Additionally, teacher preparation programs often do not systematically equip future educators with models or tools to teach CTS within hybrid or online environments, creating a significant gap in both theory and practice.

This study addresses these gaps by proposing a structured, research-informed PD workshop aimed at pre-service teachers and grounded in two validated instructional frameworks: Paul and Elder's Intellectual Standards and Merrill's First Principles of Instruction. Unlike most studies that focus solely on strategy efficacy, this research also investigates the perceptions, challenges, and implementation experiences of both TAs and pre-service teachers. It goes further by integrating AI tools, such as ChatGPT, to personalize learning and scaffold critical thinking processes. Through document analysis, interviews, and thematic coding, the study offers actionable insights into designing and evaluating PD models that support CTS in hybrid learning environments, thereby advancing the conversation on effective teacher preparation in the digital age.

III. Strategies For Teching and fostering CTS

Integrating CTS into higher education requires effective models, methods, and tools for both instruction and assessment [30] [31]. The COVID-19 pandemic significantly disrupted higher education, leading to the widespread adoption of educational technology, which has played a crucial role in fostering CTS in HL environments [32][33] [34]. CTS is recognized as a key 21st-century competency, prompting educators to integrate HOT skills into classrooms to help students process information critically, make sound judgments, and think creatively [35] [36]. Problem-Based Learning (PBL), which involves engaging with real-world scenarios, has proven to be an effective strategy for fostering CTS in hybrid settings, enhancing students' problem-solving skills and decision-making abilities. Additionally, active learning strategies (see Figure 1 below), such as questioning techniques and discussions, combined with careful instructional design and the strategic use of technology, create dynamic environments that promote CTS [37]. CTS is indispensable across disciplines and requires innovative pedagogical approaches that blend theoretical knowledge with practical, real-world experiences [38].

To address these challenges, educators are encouraged to incorporate HOT skills, as CTS remains a vital 21st-century competency [35]. PBL and active learning strategies, including questioning and discussions, effectively foster CTS in hybrid environments [36] [37]. By combining these approaches with strategic technology use and thoughtful instructional design, educators can create dynamic learning environments that enhance students' critical thinking, decision-making, and problem-solving skills [38].

A review of the literature reveals several effective strategies, including debate, discussion, SQ, project-based learning (PBL), Team-based learning (TBL), PBL, and DBL, to name a few. These strategies, when combined with careful instructional design and the strategic use of technology, can create dynamic learning environments that empower students to think critically, analyze information, and develop well-reasoned perspectives.

IV. Instructional Framework for Fostering Critical Thinking Skills (CTS) in Hybrid Learning Environments

This section presents the theoretical frameworks used to design the PD workshop, integrating cognitive standards and instructional strategies to promote CTS in HL environments.

A. Paul and Elder's Intellectual Standards Model

Paul and Elder's model offers a comprehensive structure for enhancing CTS through nine interrelated intellectual standards: clarity, accuracy, precision, relevance, depth, breadth, logic, significance, and fairness [39] [40]. These standards guide learners in evaluating arguments, questioning assumptions, and applying metacognitive strategies—essential for rational judgment and deep learning, particularly in hybrid contexts [41].

Each standard plays a distinct role: clarity and accuracy ensure understanding and correctness; depth and breadth address complexity and perspective; while logic and fairness guide sound reasoning and unbiased analysis [42] [43] [44] [45]. Their integration supports dialogic teaching methods, such as SQ, which prompt learners to identify assumptions and construct well-reasoned arguments [46] [47].

Additionally, the nine intellectual standards (see Figure 1) guide clear and effective thinking. Clarity ensures ideas are understandable and free of confusion. Accuracy requires statements to be true and verifiable. Precision adds necessary detail and specificity. Relevance ensures each point relates directly to the issue. Depth addresses the complexity of problems, avoiding shallow reasoning. Breadth involves considering multiple viewpoints. Logic ensures that ideas fit

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together coherently. Significance focuses on what matters most in a discussion. Fairness demands impartiality and respect for all perspectives. Together, these standards support thoughtful, ethical, and reasoned decision-making.

Applied in higher education, especially for pre-service teachers, these standards offer a foundation for designing course content, assignments, and reflective tasks that promote CTS [48] [49]. However, challenges in HL settings include ensuring students' effective use of these standards during digital learning and information-seeking processes.

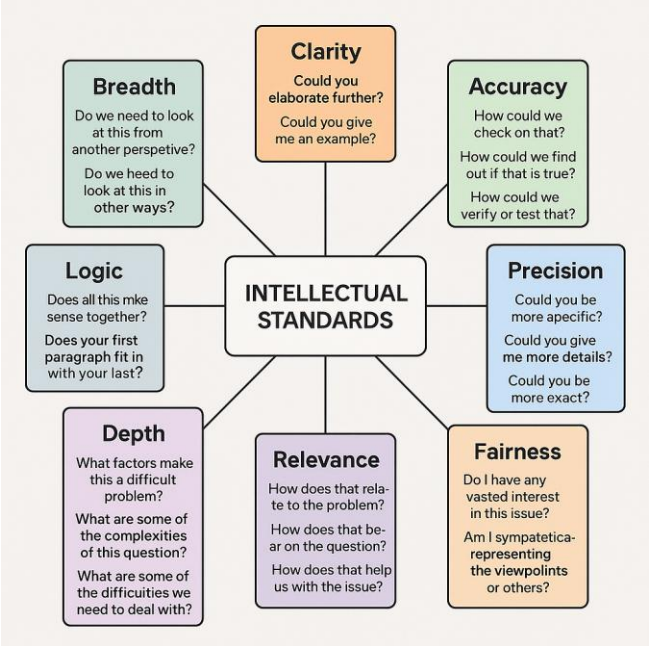

Figure 1. Paul and Elder's model of intellectual standards.

B. *Merrill's First Principles of Instruction*

Merrill's instructional design model complements Paul and Elder by offering a practical framework for structuring active, task-based learning (TBL) in HL environments [50]. It emphasizes four core principles: Activation, Demonstration, Application, and Integration—each supporting the development of CTS by engaging learners in real-world problem-solving [51] [52] [53].

In this study, these principles are applied as follows:

- Activation: Pre-class quizzes and reflective prompts bridge prior knowledge with new content.
- Demonstration: Flipped learning via video-based modules enables self-paced engagement [54].
- Application: In-class tasks, such as case studies and group projects, allow skill practice and feedback.
  Integration: Reflective discussions and scenario-based tasks foster transfer of learning and Higher-Order Thinking (HOT) [55] [56] [57].

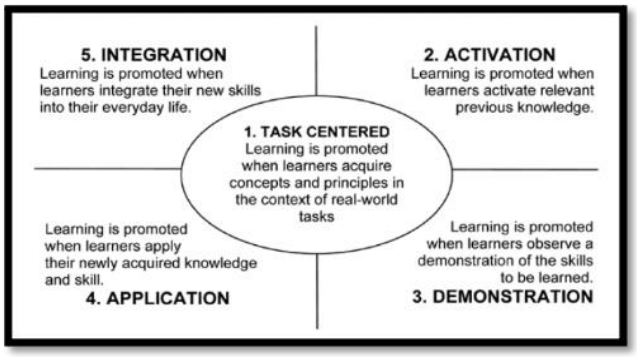

Figure 2. Merrill's First Principles of Instruction.

This research employs both Paul and Elder's standards and Merrill's principles to design a PD workshop that equips pre-service teachers with the tools to foster CTS in hybrid settings. Paul and Elder offer what of CT (cognitive standards), while Merrill provides the how (instructional strategy). Their integration ensures that teachers not only understand and assess ideas critically but also apply this understanding through structured, active learning processes. This framework addresses the pedagogical demands of hybrid education while supporting long-term development of reflective, fair-minded educators.

V. Research Design and Methodology

This study adopts a qualitative case study design to examine how a PD workshop supports pre-service teachers in fostering CTS within HL environments. A case study is ideal for exploring contemporary educational practices within their real-world context, especially when the boundaries between the phenomenon (CTS development) and its environment (hybrid instruction) are blurred. The bounded case is the implementation of a PD workshop in the EDCT 2030 (educational computer technology) course at a Midwestern public university, Ohio University.

Data will be collected during the fall semester 2025 through three qualitative sources: a preliminary open-ended survey, document analysis, and semi-structured interviews. The survey will gather insights into participants' initial understanding of CTS, their teaching experiences, and perceptions of HL. It will also collect demographic information such as age, instructional background, and familiarity with technology. The survey results will inform interview protocol development and document analysis focus.

Following the survey, document analysis will be conducted on instructional materials from the EDCT 2030 course, including syllabi, lesson plans, discussion transcripts, and assignments. These artifacts will be examined using an IRB-approved coding protocol to identify pedagogical strategies, CTS integration, and instructional alignment with hybrid teaching principles.

Semi-structured interviews will be conducted with selected participants to explore how they implemented CTS strategies and reflected on the workshop's impact. Interview questions will be adapted from validated sources and tailored

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to reflect themes identified in the survey. All interviews will be transcribed and thematically analyzed [58].

The participants will be pre-service teachers enrolled in EDCT 2030: Instructional Technology in Education, a required course for initial licensure. A purposive sampling method will be used to recruit individuals involved in HL environments. Participation is voluntary and conducted under IRB protocols.

At the center of this study is a two-sessions workshop, designed to build CTS instructional competencies. Each session lasts approximately three hours. The first session introduces theoretical models, including Paul and Elder's Intellectual Standards and Merrill's First Principles of Instruction, supported by active learning strategies such as SBL and PBL. The second session emphasizes practical application through role-play, debate, and collaborative activity design using techniques like GBL and PBL. Participants reflect on these experiences and discuss challenges and implementation strategies.

The effectiveness of the workshop will be assessed through participant reflections and feedback forms. Data will be analyzed through thematic analysis using a three-phase process: open coding, axial coding, and selective coding. Triangulation of survey, document, and interview data will strengthen the study's trustworthiness. Additional strategies to ensure rigor include member checking, peer debriefing, and an audit trail.

VI. Expected Outcomes and Significance

This study is expected to yield valuable insights into how PD workshops can enhance pre-service teachers' ability to foster CTS within HL contexts. By engaging participants in a structured, interactive workshop grounded in established instructional models—such as Paul and Elder's Intellectual Standards and Merrill's First Principles of Instruction—the study anticipates notable shifts in participants' pedagogical knowledge, instructional design choices, and classroom implementation of CTS strategies.

It is anticipated that pre-service teachers will demonstrate increased awareness and understanding of CTS as a pedagogical goal, along with a greater ability to translate theory into practice through active learning methods such as PBL, SBL, DBL and GBL. Additionally, participants are expected to gain confidence in designing and facilitating learning experiences that challenge students to reason, analyze, and reflect critically.

The study also expects to identify practical and transferable strategies for embedding CTS within digital and hybrid instructional environments. These findings will be informed by a thematic analysis of interviews, surveys, and instructional documents and will offer evidence-based recommendations for teacher educators and curriculum designers seeking to prepare future teachers for 21st-century educational demands.

The broader significance of this study lies in its contribution to the fields of teacher education, instructional design, and PD. By emphasizing CT in hybrid settings, this research aligns with national and global priorities for HOT and digital pedagogy. Its outcomes may inform institutional policies on faculty training, program development, and technology integration, thereby supporting the creation of adaptable, reflective, and critically engaged educators.

To further illustrate the anticipated outcomes and persistent challenges of the professional development workshop, Table I summarizes key focus areas, observed benefits, and identified gaps in implementing CTS strategies in hybrid learning environments.

TABLE I. WORKSHOP OUTCOMES AND GAPS

Focus Area	Observed Outcomes	Identified Gaps
Instructional Strategy Integration	Increased use of Socratic questioning and scenario-based learning	Need for consistent application across sessions
Pre-service Teacher Engagement	Improved confidence in applying CTS	Limited opportunities for collaborative peer
Use of AI and Digital Tools	Effective use of tools like ChatGPT for reflection and feedback	Variability in access and digital literacy levels
Sustainability of CTS Practices	Short-term improvement in instructional	Lack of long-term follow-up and support mechanisms
Institutional Support	Positive feedback from participants on PD design	Insufficient policy-level incentives for CTS integration

Ultimately, this study contributes to the ongoing effort to equip educators with the tools, frameworks, and dispositions needed to prepare students for complex, real-world challenges through thoughtful, critical engagement.

VII. Discussion and Limitations

This study provides valuable insights into fostering CTS in HL environments; however, several limitations must be acknowledged. Conducted solely at Patton College of Education at Ohio University, its institutional specificity may limit the generalizability of findings. As a qualitative case study, the research relies on participants' self-reported data and researcher interpretations, which may introduce bias despite methodological safeguards. The study captures short-term outcomes and does not assess long-term pedagogical shifts. Variability in HL technologies, instructional methods, and students' digital literacy may also affect the consistency of results. Furthermore, focusing on the EDCT 2030 course and Teaching Assistants may not fully represent broader

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educational contexts or faculty perspectives in other disciplines. Finally, given the fast-paced evolution of AI and digital tools in education, some practices examined may quickly become outdated. Ongoing research is essential to monitor technological changes and their implications for promoting CTS in higher education.

VIII. CONCLUSION

This article examines how a PD workshop can help teachers foster CTS in HL environments. Using a qualitative case study design, the study highlights the importance of theory-based, practical instructional strategies grounded in Paul and Elder's Intellectual Standards and Merrill's First Principles of Instruction.

Findings are expected to show that active learning methods—such as case studies, PBL, and collaborative tasks—support pre-service teachers in applying theory to practice. The workshop helps build educators' confidence and competence in integrating CTS into technology-mediated learning.

The study also explores the use of multimedia and AI tools. While some participants may feel equipped to use them to enhance CTS, others may reveal gaps in training, suggesting a need for continued professional support.

This research adds to the field of teacher education by offering practical insights and advocating for evidence-based approaches to developing CTS in HL settings.

REFERENCES

[1] Y. Walter, "Embracing the future of artificial intelligence in the classroom: The relevance of AI literacy, prompt engineering, and critical thinking in modern education," *Int. J. Educ. Technol. Higher Educ.*, vol. 21, no. 15, 2024, doi: 10.1186/s41239-024-00448-3.

[2] V. H. Paulsen, "Challenging aspects of critical thinking: A mixed-methods study of students' test results, students' reasoning, and teaching strategies," OECD Publishing, Paris, France, 2022.

[3] M. U mami, M. Saleh, *et al.*, "The implementation of hybrid computer mediated collaborative learning (HCMCL) for promoting students' critical thinking at IAIN Salatiga, Indonesia," *Arab World English J.*, 2018.

[4] A. Saroyan, "Fostering creativity and critical thinking in university teaching and learning: Considerations for academics and their professional learning," OECD Publishing, Paris, France, 2023, doi: 10.1787/09b1cb3b-en.

[5] D. N. Smith, "Teachers' perceptions of student engagement in a hybrid learning environment," Ph.D. dissertation, Walden Univ., Minneapolis, MN, USA, 2018.

[6] M. Moore *et al.*, "Mastering the blend: A professional development program for K-12 teachers," *J. Online Learn. Res.*, vol. 3, no. 2, 2017.

[7] R. G. Saadé, D. Morin, and J. Thomas, "Critical thinking in e-learning environments," *Comput. Human Behav.*, vol. 28, no. 5, pp. 1608–1617, Sep. 2012, doi: 10.1016/j.chb.2012.03.025.

[8] A. Makhene, "The use of the Socratic inquiry to facilitate critical thinking in nursing education," *Health SA Gesondheid*, vol. 24, 2019, doi: 10.4102/hsag.v24i0.1224.

[9] K. L. Flores *et al.*, "Deficient critical thinking skills among college graduates: Implications for leadership," *Educ. Philos. Theory*, vol. 44, no. 2, pp. 212–230, 2010, doi: 10.1111/j.1469-5812.2010.00672.x.

[10] D. Yulianti, "Problem based learning model improve critical thinking ability," in *Proc. Soc. Humanit. Educ. Stud. (SHEs) Conf. Ser.*, vol. 3, no. 4, 2021, pp. 46–55, doi: 10.20961/shes.v3i4.53250.

[11] S. V. Saputri *et al.*, "Development of critical thinking ability oriented textbook on electrolyte and non-electrolyte solution materials," *Jurnal Pendidikan Matematika dan IPA*, vol. 13, no. 1, pp. 13–25, 2022, doi: 10.26418/jpmipa.v13i1.34741.

[12] Y. Ho, B.-Y. Chen, and C. Li, "Thinking more wisely: Using the Socratic method to develop critical thinking skills amongst healthcare students," *BMC Med. Educ.*, vol. 23, no. 1, 2023, doi: 10.1186/s12909-023-04134-2.

[13] R. Acim, "The Socratic method of instruction: An experience with a reading comprehension course," *J. Educ. Res. Pract.*, vol. 8, no. 1, 2018, doi: 10.5590/jerap.2018.08.1.04.

[14] B. F. Chorzempa and L. Lapidus, "To find yourself, think for yourself: Using Socratic seminars to promote critical thinking," *Teach. Except. Child.*, vol. 41, no. 3, pp. 54–59, 2009, doi: 10.1177/004005990904100306.

[15] L. Nelson, "The Socratic method," *Thinking: J. Philos. Child.*, vol. 2, no. 2, pp. 34–39, 1980, doi: 10.5840/thinking1980228.

[16] B. Gower and M. C. Stokes, "Socratic questions," in *Critical Thinking: An Introduction to Reasoning Well*, 2nd ed. London, UK: Routledge, 2018, ch. 2, doi: 10.4324/9780429450136.

[17] I. Kurnia and C. Caswita, "Students' critical thinking ability in solving contextual problems at a junior high school," *J. Phys.: Conf. Ser.*, vol. 1521, no. 3, p. 032067, 2020, doi: 10.1088/1742-6596/1521/3/032067

[18] L. Hanum *et al.*, "Development of learning devices based on ethnoscience project based learning to improve students' critical thinking skills," *J. Pendidik. Sains Indones.*, vol. 11, no. 2, pp. 288–299, 2023, doi: 10.24815/jpsi.v11i2.28294.

[19] Z. Yan, "English as a foreign language teachers' critical thinking ability and L2 students' classroom engagement," *Front. Psychol.*, vol. 12, p. 773138, 2021, doi: 10.3389/fpsyg.2021.773138.

[20] E. M. Iringan, "Instructional exposure of senior high school students to approaches that promote critical thinking and problem-solving skills," *J. Asian Res.*, vol. 5, no. 1, pp. 1–15, 2021, doi: 10.22158/jar.v5n1p1.

[21] T. Schlosser, C. Parkes, and J. J. Brunsdon, "Advocating for diverse professional development in physical education: Professional learning communities and teacher learning walks," *Strategies*, vol. 34, no. 3, pp. 42–48, 2021, doi: 10.1080/08924562.2021.1896934.

[22] L. Darling-Hammond, M. E. Hyler, and M. Gardner, "Effective teacher professional development," Learning Policy Institute, Palo Alto, CA, USA, 2017, doi: 10.54300/122.311.

[23] M. Hafiz and T. Kwong, "Challenges and opportunities in hybrid learning: A case study," *J. Comput. High. Educ.*, vol. 31, no. 2, pp. 293–310, 2019, doi: 10.1007/s12528-019-09227-w.

[24] E. R. Havea and S. Mohanty, "Blended learning in teacher education: A systematic review," *Cogent Educ.*, vol. 7, no. 1, p. 1848723, 2020, doi: 10.1080/2331186X.2020.1848723.

[25] J. Farrow *et al.*, "Teacher professional development in hybrid learning environments: Challenges and

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innovations," *Prof. Develop. Educ.*, vol. 48, no. 5, pp. 789–803, 2022, doi: 10.1080/19415257.2021.1987087.

[26] T. L. Good and A. D. Weaver, "Teacher professional development: A review of the literature," *Rev. Educ. Res.*, vol. 73, no. 1, pp. 1–30, 2003, doi: 10.3102/00346543073001001.

[27] R. S. Davies and R. E. West, "Technology integration in schools: A meta-narrative review," *TechTrends*, vol. 57, no. 5, pp. 55–63, 2013, doi: 10.1007/s11528-013-0693-6.

[28] B. Love et al., "Hybrid learning environments: Bridging the gap between theory and practice," *J. Digit. Learn. Teach. Educ.*, vol. 36, no. 3, pp. 156–170, 2020, doi: 10.1080/21532974.2020.1780407.

[29] A. Uzorka, S. Namara, and A. O. Olaniyan, "Modern technology adoption and professional development of lecturers," *Educ. Inf. Technol.*, vol. 28, no. 11, pp. 14693–14714, 2023, doi: 10.1007/s10639-023-11790-w.

[30] J. Davis *et al.*, "Models for critical thinking integration in higher education," *High. Educ. Res. Dev.*, vol. 42, no. 4, pp. 1–15, 2023.

[31] R. Kaur and K. Chahal, "Critical thinking in hybrid learning: A meta-analysis," *J. Educ. Technol.*, vol. 15, no. 2, pp. 45–60, 2023.

[32] C. Hodges *et al.*, "The difference between emergency remote teaching and online learning," *Educ. Technol. Res. Dev.*, vol. 68, no. 4, pp. 1–15, 2020, doi: 10.1186/s41239-020-00231-2.

[33] M. Kerres *et al.*, "Digital learning and teaching: A systematic review of frameworks," in *Digital Education in the Post-Pandemic Era*. Cham, Switzerland: Springer, 2022, pp. 89–112, doi: 10.1007/978-3-030-90944-4_6.

[34] S. Pokhrel *et al.*, "Impact of COVID-19 on higher education: A global perspective," *SAGE Open*, vol. 11, no. 4, pp. 1–15, 2021, doi: 10.1177/2347631120983481.

[35] H. M. Nor and A. J. Sihes, "Critical thinking skills in education: A systematic literature review," *Int. J. Acad. Res. Bus. Soc. Sci.*, vol. 11, no. 11, pp. 1–15, 2021, doi: 10.6007/ijarbss/v11-i11/11529.

[36] E. Petek and H. Bedir, "Integrating higher order thinking skills (HOTS) into classroom practices," *Eurasian J. Educ. Res.*, vol. 18, no. 74, pp. 1–20, 2018, doi: 10.14689/ejer.2018.74.6.

[37] H. Haghparast *et al.*, "Active learning strategies for enhancing critical thinking," *Int. Educ. Stud.*, vol. 6, no. 11, pp. 195–204, 2013, doi: 10.5539/ies.v6n11p195.

[38] M. A. Wani and S. Hussain, "Innovative pedagogical approaches for 21st-century classrooms," *J. Educ. Innov.*, vol. 15, no. 1, pp. 1–18, 2024.

[39] R. Paul and L. Elder, *Critical Thinking: Tools for Taking Charge of Your Learning and Your Life*. Dillon Beach, CA: Foundation for Critical Thinking, 2001.

[40] K. K. Papp *et al.*, "Applying Paul and Elder's intellectual standards to enhance critical thinking," *J. Sci. Educ. Technol.*, vol. 23, no. 5, pp. 703–712, 2014, doi: 10.1007/s10956-014-9511-0.

[41] R. Hidayah and M. Ulfah, "Critical thinking in hybrid learning environments: A case study," in *Proc. 3rd Int. Conf. Educ.*, 2020, pp. 1–10, doi: 10.2991/assehr.k.200803.001.

[42] R. Paul and G. Nosich, "A model for critical thinking across the curriculum," *Inquiry: Critical Thinking Across the Disciplines*, vol. 7, no. 2, pp. 21–30, 1992, doi: 10.5840/inquiryct1992721.

[43] F. Karakas, "Critical thinking in management education: A review and framework," *Academy of Management Learning & Education*, vol. 9, no. 4, pp. 673–693, 2010, doi: 10.5465/amle.2010.48661191.

[44] L. J. Fero *et al.*, "Critical thinking skills in nursing students: A longitudinal study," *Journal of Nursing Education*, vol. 49, no. 3, pp. 133–138, 2010, doi: 10.3928/01484834-20100331-03.

[45] R. Stephenson, "Critical thinking and pedagogy: Strategies for classroom practice," *Educational Leadership*, vol. 42, no. 8, pp. 50–53, 1985.

[46] C. Golding, "Socratic questioning in education: A tool for critical thinking," *Educational Philosophy and Theory*, vol. 43, no. 7, pp. 797–808, 2011, doi: 10.1111/j.1469-5812.2010.00670.x.

[47] K. L. Flores et al., "Critical thinking in higher education: A review of the literature," Stud. Higher Educ., vol. 37, no. 8, pp. 1–15, 2012, doi: 10.1080/03075079.2011.586995.

[48] H. Belchior-Rocha and I. Casquilho-Martins, "Designing critical thinking courses in higher education: Challenges and solutions," *Studies in Higher Education*, vol. 46, no. 8, pp. 1605–1618, 2021, doi: 10.1080/03075079.2019.1704723.

[49] A. Said *et al.*, "Critical thinking in science education: A meta-analysis," *International Journal of Science Education*, vol. 41, no. 12, pp. 1650–1670, 2019, doi: 10.1080/09500693.2019.1623432.

[50] M. D. Merrill, *First Principles of Instruction*. San Francisco, CA, USA: Pfeiffer, 2012.

[51] M. English, "Merrill's first principles of instruction: Applications in hybrid learning," *Educational Technology Research and Development*, vol. 71, no. 3, pp. 1–18, 2023, doi: 10.1007/s11423-023-10243-2.

[52] C. P. Dwyer *et al.*, "Critical thinking in higher education: A review of the literature," *Higher Education Research & Development*, vol. 33, no. 4, pp. 781–795, 2014, doi: 10.1080/07294360.2013.860567.

[53] [52] R. Walker and M. Brown, "Hybrid learning and critical thinking: A case study," *Journal of Educational Technology & Society*, vol. 23, no. 2, pp. 145–158, 2020.

[54] R. E. Mayer, *Multimedia Learning*. Cambridge, UK: Cambridge University Press, 2006, doi: 10.1017/CBO9780511811678.

[55] O. H. Lowry *et al.*, "Protein measurement with the Folin phenol reagent," *Journal of Biological Chemistry*, vol. 193, no. 1, pp. 265–275, 1951, doi: 10.1016/S0021-9258(19)52451-6.

[56] P. Hsieh *et al.*, "Technology-enhanced learning environments for critical thinking," *Computers & Education*, vol. 49, no. 4, pp. 903–915, 2007, doi: 10.1016/j.compedu.2005.12.003.

[57] K. E. Linder, "Hybrid learning design: Strategies for blended environments," *Journal of Interactive Media in Education*, vol. 2017, no. 1, pp. 1–12, 2017, doi: 10.5334/jime.435.

[58] D. Widyartono, "Scenario-based tasks for critical thinking in hybrid learning," *Interactive Learning Environments*, 2021, doi: 10.1080/10494820.2021.1979045.

[59] E. Purwaningsih *et al.*, "Improving students' critical thinking skills through STEM-integrated modeling instruction," in *AIP Conference Proceedings*, vol. 2215, 2020, doi: 10.1063/5.0000776.

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