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# 21st Century Learning Trends : What Educators Need to Know

**Alfaza Ranggana[1]✉, Wahyudin[2], Gunarso[3], Endah Permatasari[4]**
Universitas Pendidikan Indonesia, Indonesia[1,2,3,4]
e-mail : alfaza@upi.edu[1], wahyudin_sanusi@upi.edu[2], gunarso@upi.edu[3], endah@upi.edu[4]

**Abstrak**

Pendidikan abad ke-21 menekankan integrasi teknologi dan pengembangan keterampilan berpikir siswa untuk menghadapi perubahan global. Penelitian ini bertujuan untuk memberikan wawasan kepada tenaga pendidik secara umum tentang pentingnya menjaga relevansi atau hubungan antara materi pelajaran dengan perkembangan teknologi di era abad ke-21, menggunakan studi literatur dan studi kasus. Hasil penelitian menunjukkan bahwa tren utama dalam pendidikan abad ke-21 meliputi integrasi teknologi, penekanan pada keterampilan berpikir siswa, pendidikan karakter, promosi keterampilan inovatif dan kewirausahaan, serta pendekatan berbasis STEM. Simpulan dari penelitian ini menyoroti perlunya pendidik untuk memperbarui metode pengajaran mereka agar tetap relevan dengan kebutuhan siswa dan perkembangan teknologi di abad ke-21.
**Kata Kunci:** Abad ke-21, Pembelajaran, Berpikir Komputasi, Berpikir Kritis.

***Abstract***

*Education in the 21st century emphasizes the integration of technology and the development of students' critical thinking skills to cope with global changes. This research aims to provide insights to educators on the importance of maintaining the relevance of teaching materials with technological advancements in the 21st century, using literature analysis and case studies. The findings of the research indicate that major trends in 21st-century education include technology integration, emphasis on students' critical thinking skills, character education, promotion of innovative skills and entrepreneurship, and STEM-based approaches. The conclusion of this research highlights the necessity for educators to update their teaching methods to remain relevant to students' needs and technological developments in the 21st century.*
***Keywords:*** *21st Century, Learning, Computational Thinking, Critical Thinking*.



✉ Corresponding author :
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## INTRODUCTION

In the epoch of the 21st century, the realm of education has witnessed significant transformations and evolving trends shaped by the progress of technology, societal shifts, and changing student needs. These shifts, highlighted by Naing et al. (2022), Chan (2022), Hill (2012), Lim et al. (2021), and Solovov & Menshikova (2022), are more pronounced in advanced nations, while developing countries are navigating necessary pathways to keep pace. This educational metamorphosis has fostered innovative teaching and learning approaches, exploring novel pedagogical strategies and technologies as outlined by Lim et al. (2021), Solovov & Menshikova (2022), and Morreale (2020). Particularly, the digital revolution, emphasized by Chan (2022) and Lim et al. (2021), has transformed traditional education into digitally assisted learning, with the COVID-19 pandemic accelerating this shift through widespread adoption of digital tools like GMeet, Zoom, MSTeams, and Learning Management Systems such as Google Classroom and Moodle. Consequently, there's been a transition from rote memorization to cultivating critical thinking skills, computational thinking patterns, and cross-cultural understanding, echoing Hill's findings (2012). Moreover, the proliferation of social media and information technology, noted by Smyrnova-Trybulska (2019), has further impacted educational practices, empowering students with resources beyond traditional classroom instruction.

Critical thinking's paramount importance in the 21st-century education landscape is widely acknowledged, with Quieng et al. (2015) asserting it as fundamental, a sentiment echoed by Sasmita et al. (2023). This shift demands students to utilize their cognitive abilities to solve problems independently, crucial for navigating the modern world. Consequently, emphasis on critical thinking, closely linked with collaboration, creativity, and communication, is deemed essential (Prastyaningrum et al., 2023), offering myriad benefits including improved academic performance (Li & Ren, 2020; Aldraiweesh, 2023) and problem-solving prowess (Triyanto et al., 2022; Alberida et al., 2022). As students confront 21st-century challenges, nurturing robust critical thinking skills becomes imperative (Sofiyana & Sholihah, 2022), essential for adapting to the complexities of modernity (Triyanto et al., 2022; Sundapa, 2022).

Similarly, computational thinking emerges as a critical skill for 21st-century students, guiding problem-solving and systematic behavior (Haseski et al., 2018). Rooted in computer science, it's recognized as vital for modern competence (Voogt & Erstad, 2018), prerequisite for understanding technological advancements. Integrated into various teaching methods and strategies, computational thinking fosters critical thinking and 21st-century competencies (Philippou & Psomos, 2022), evident in game-based learning activities (Rim, 2017). Considered foundational alongside traditional skills, mastering computational thinking is crucial for navigating the complexities of the modern era (Ferrari et al., 2019; Ferrari et al., 2018; Assainova, 2023). In essence, computational thinking stands as an integral component of modern thinking skills, essential for students in the 21st century.

After the introductory exploration, as previously discussed, it is asserted that in the 21st century, students must engage in critical thinking to meet the demands of industries and society. Proficiency in critical thinking can be augmented by adopting one of the computational thinking patterns, thinking akin to a computer. In the ubiquitous digital technology era, transforming education to develop computational thinking patterns to enhance the critical thinking abilities of 21st-century students becomes more dynamic and captivating. For instance, in the past, not everyone could afford to buy a computer; now, almost every student can have technology at their fingertips, namely, a smartphone. Previously, there was no software that could support distance learning, but now there are numerous software applications that assist students in learning wherever and whenever they desire. If a student does not have a computer to delve into computer sciences, they can still learn through Unplugged learning methods, allowing them to grasp computer knowledge without an actual computer (Bell et al., 1998) .

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## METHOD

In this research, a study is conducted on 21st-century student learning, with the aim of addressing the following questions:

1. What is meant by critical thinking?
2. What is meant by computational thinking, and how does it relate to developing critical thinking patterns in students?
3. What kind of learning can support students' computational thinking patterns?

The research methodology involves a literature review of 38 papers, with the criteria stated in **Table 1**. Papers that are used for literature review need to be published at least five years before this research is conducted, to maintain the current trend that is currently discussed in this research. The findings from the literature review are then utilized to address the three previously posed questions. After answering the questions, conclusions and recommendations are formulated for future research endeavors. After the papers are collected, the next step is for the authors to read the papers' contents. To efficiently read the papers, all authors are given different numbers of papers to read and store its content in shared excel file. The first author is given 20 papers, second to fourth authors are given 6 papers each.

**Table 1**. Accepted and Rejected Paper Criteria for Literature Review

| Accepted Paper Criteria | Rejected Paper Criteria |
|---|---|
| Journal Article, Peer-reviewed Article, Confrence Paper | Book, Book Chapter, Review, Thesis |
| Paper published from 2018 – 2023 | Paper Published before 2018 |
| Paper written in English or Bahasa Indonesia | Paper not written in English or Bahasa Indonesia |

This research is using Publish or Perish 8 and Google Scholar as its academic database. The keywords that are used in this search are “Learning” AND “Trends” AND “Educators”. There are more than 100 papers after the initial search is conducted, but after the filtering using the criteria in **Table 1**, from hundreds of papers down to 38 papers, the process of filtering can be seen in **Figure 1**.

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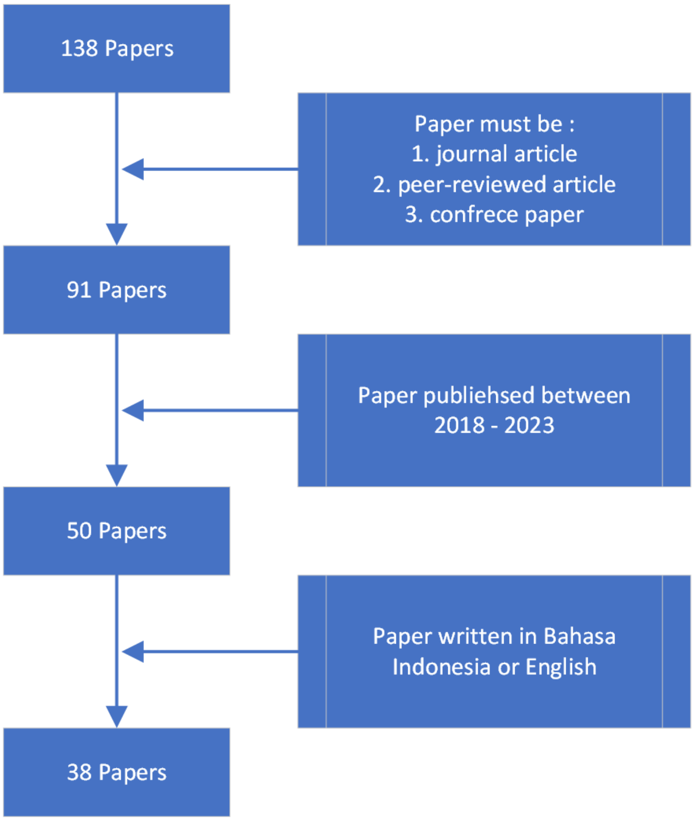


**Figure 1.** The filtering process for collecting academic papers

## RESULT AND FINDINGS

The result to answer the three scientific questions posed in the Method section has been found, and the results of the study will be presented in this section according to each question.

### What is meant by critical thinking?

Critical thinking ability is defined as the "ability to make purposeful and rational judgments about something or an opinion according to standards." It consists of critical thinking dispositions and critical thinking skills. Critical thinking dispositions refer to consistent thinking habits when solving problems, analyzing, and making decisions. Positive critical dispositions benefit human progress and social development, while negative critical dispositions tend to harm society. Critical thinking skills refer to the application of appropriate evaluation standards for conscious thinking and ultimately making rational judgments. This paper primarily focuses on studying critical thinking skills. Scholars have pointed out the lack of critical thinking and claimed that the English department lacks specific critical thinking skills. Since then, more scholars have paid attention to this issue, conducting research and discussions in various aspects. Many scholars have discussed the development of critical thinking measurement tools. A series of comparative studies were conducted on critical thinking abilities between foreign language students and students in other arts and sciences. (Li J. Ren Y., 2020).

Another meaning of critical thinking refers to the cognitive ability and skills that students possess to analyze, evaluate, and make judgments or decisions based on certain criteria. It involves reflecting on ideas, making connections between thoughts, and engaging in higher-order thinking skills. Critical thinking is often considered a distinguishing characteristic between humans and other living beings and is crucial for human life. It includes attributes such as analytical thinking, problem-solving, creative thinking, and effective

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communication, making humans one of the most intelligent creatures on Earth. This is recognized as an essential requirement for students in higher education and integrated into assessment practices. However, there is no exact consensus on the true meaning of critical thinking or how it can be achieved; essentially, critical thinking will be reflected later when students are engaged with real-world problems. The concept of critical thinking is often explored in the context of various "types" of specific thinking, such as standard, non-standard, imaginative, and creative thinking.

**What is meant by computational thinking and its relationship in developing critical thinking patterns in students?**

Computational thinking refers to a problem-solving approach that draws inspiration from computer science concepts and practices. It involves breaking down complex problems into smaller, more manageable parts and applying logical and algorithmic thinking to solve them. Computational thinking encompasses various cognitive skills such as decomposition, pattern recognition, abstraction, and algorithmic design. It is not limited to programming or computer-related tasks but can be applied to various disciplines and real-world scenarios. Computational thinking can enhance critical thinking by providing a structured framework for analyzing and solving problems. The computational thinking process encourages individuals to approach problems systematically, identify patterns and regularities, and consider multiple solutions. By breaking down complex problems into smaller components, computational thinking enables individuals to analyze and evaluate each part independently, enhancing their analytical thinking abilities. Furthermore, the emphasis on algorithmic design and logical reasoning in computational thinking promotes the development of logical thinking and reasoning skills. Through computational thinking, individuals also gain a deeper understanding of problem-solving strategies. They learn to consider different approaches and evaluate the effectiveness of different solutions. This promotes critical thinking by encouraging individuals to question assumptions, evaluate evidence, and make decisions. Additionally, computational thinking encourages individuals to think creatively and explore innovative solutions. It promotes a mindset of perseverance, as individuals experiment with different strategies and iterate on their solutions. This iterative problem-solving process reinforces the importance of reflection and continuous improvement, key components of critical thinking. Moreover, computational thinking fosters collaboration and communication. In collaborative problem-solving tasks, individuals must articulate their thoughts, justify their decisions, and engage in effective communication. These skills are crucial for critical thinking, involving the exchange of ideas, critical analysis of others' perspectives, and the ability to construct coherent arguments. Overall, computational thinking provides a structured problem-solving approach that complements and enhances critical thinking skills. It promotes analytical thinking, logical reasoning, creativity, systematic problem-solving, and effective communication—all of which contribute to the development of robust critical thinking abilities.

**What kind of learning can support students' computational thinking patterns?**

To enhance students' computational thinking skills, various learning approaches and strategies can be employed. These approaches focus on developing cognitive abilities and problem-solving techniques related to computational thinking. Some suitable learning methods to improve students' computational thinking skills include:

1. Programming and Coding: Introducing students to programming languages and coding exercises can effectively develop their computational thinking abilities. Through direct coding experiences, students learn to break down problems into smaller components, develop algorithms, and apply logical thinking to create functional solutions.
2. Algorithmic Thinking: Teaching students about algorithms and algorithm design helps them understand step-by-step procedures used to solve problems. Activities involving algorithm

development for specific tasks or sorting and searching algorithms can enhance students' algorithmic thinking skills.

3. Puzzles and Challenges: Involving students in puzzles, logic problems, and computational thinking challenges can stimulate their problem-solving abilities. These activities encourage students to think critically, analyze patterns, and devise efficient strategies for solving complex problems.
4. Modeling and Computational Simulation: Engaging students in creating and analyzing models and computational simulations helps them understand abstract concepts and systems. This approach develops their ability to identify patterns, make predictions, and test hypotheses using computational tools.
5. Computational Robotics and Physical Computing: Integrating robotics and physical computing devices, such as programmable microcontrollers or robots, allows students to apply computational thinking principles in a tangible and practical way. Students can learn to program these devices, design algorithms, and solve real-world problems using interactive and engaging methods.
6. Game-Based Learning: Leveraging game-based learning platforms or educational video games with computational thinking elements provides an interactive and engaging learning environment. Students navigate through game levels that require problem-solving, algorithmic thinking, and logical reasoning to progress.
7. Collaborative Projects: Encouraging students to collaborate on projects that require computational thinking fosters teamwork, communication, and problem-solving skills. Students can collaborate on designing and implementing various computational tasks, enabling them to exchange ideas, evaluate different approaches, and learn from their peers.
8. Cross-Disciplinary Integration: Integrating computational thinking across different subjects strengthens its application and relevance in various disciplines. For example, incorporating computational thinking into mathematics, science, or geography lessons helps students understand and apply computational concepts to real-world scenarios.
9. Real-World Applications: Providing opportunities for students to apply computational thinking skills in real-world contexts deepens their understanding and relevance. Projects involving data analysis, programming microcontrollers for practical purposes, or exploring AI and machine learning concepts demonstrate the impact of computational thinking in daily life.

It is essential to note that these learning methods should be appropriately scaffolded, starting with simpler tasks and gradually increasing complexity. Moreover, providing ample opportunities for direct practice, reflection, and feedback is crucial for students to effectively develop their computational thinking skills.

## DISCUSSION

In the 21st century, education has undergone significant changes and trends. The primary focus has shifted towards integrating technology and digital pedagogy, driven by students' need to develop 21st-century skills. There is also an emphasis on enhancing critical thinking skills, scientific literacy, character education, and the development of innovative and entrepreneurial skills. Global education trends lean towards STEM-based approaches, enhancing students' competencies in science, technology, engineering, and mathematics. Overall, 21st-century education aims to meet the rapidly changing demands of the world.

Critical thinking, as elucidated by scholars, encompasses not only the ability to make purposeful and rational judgments but also involves a set of dispositions and skills that contribute to problem-solving, analysis, and decision-making. The discourse surrounding critical thinking underscores its significance in fostering human progress and social development, while also acknowledging the challenges associated with its cultivation, particularly within specific disciplines like English studies. As such, this study contributes to a broader understanding of critical thinking and its implications for educational practices. Furthermore, the discussion delves into the intersection between computational thinking and critical thinking, elucidating how the former can serve as a catalyst for the development of the latter. Computational thinking, characterized by its problem-solving approach rooted in computer science principles, offers a structured framework for analyzing complex problems and devising solutions. By emphasizing skills such as decomposition, pattern recognition, and algorithmic design, computational thinking enhances individuals' analytical and logical reasoning abilities, thus complementing and enriching critical thinking processes. This nuanced exploration highlights the symbiotic relationship between computational and critical thinking, underscoring their interconnectedness in educational settings.

Moreover, the discourse extends to elucidate various learning approaches and strategies aimed at nurturing students' computational thinking patterns. From programming and coding exercises to collaborative projects and real-world applications, a diverse range of pedagogical methods are proposed to cultivate students' computational thinking skills. These approaches not only foster cognitive development but also promote creativity, problem-solving, and effective communication—all of which are integral components of critical thinking. By scaffolding learning experiences and providing opportunities for direct practice and reflection, educators can empower students to navigate the complexities of today's digital age with confidence and competence. In essence, the findings presented in this study underscore the importance of fostering critical thinking abilities within educational contexts and highlight the role of computational thinking as a catalyst for this development. By elucidating the definitions, intersections, and pedagogical implications of critical and computational thinking, this study contributes to a deeper understanding of these concepts and their implications for educational practices. Ultimately, by equipping students with the necessary cognitive skills and problem-solving strategies, educators can empower them to thrive in an increasingly complex and interconnected world.

## CONCLUSION

After conducting the literature review in this research, the author has several recommendations to be implemented, to effectively enhance students' computational thinking and critical thinking skills, educators and educational institutions may consider the following suggestions:

1. Integrate computational thinking throughout the curriculum: Incorporate computational thinking elements into various subjects and disciplines, including mathematics, science, language arts, social studies, and other relevant subjects, to demonstrate its application and relevance across different fields.
2. Provide hands-on and interactive learning experiences: Engage students in problem-solving tasks, puzzles, challenges, and real-world applications. This allows students to apply computational thinking and critical thinking skills in practical contexts, enhancing their understanding and retention of concepts.
3. Utilize technology and digital tools supporting computational thinking: Introduce programming languages, coding platforms, robotics kits, and simulation software to enable students to explore and experiment with computational concepts and develop their computational thinking skills.
4. Encourage collaborative learning and teamwork: Involve students in project-based activities that require collaboration, idea exchange, critical analysis of information, and collective problem-solving. This fosters communication, collaboration, and the development of critical thinking skills.
5. Provide opportunities for reflection, self-assessment, and feedback: Allow students to reflect on their problem-solving processes, analyze their thinking patterns, and evaluate the effectiveness of their solutions. Offer constructive feedback to guide their growth and improvement.

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6. Emphasize metacognitive strategies: Teach students to think about their own thinking processes, evaluate their understanding, and reflect on their problem-solving strategies. Metacognitive awareness enhances their ability to analyze and adjust their thinking patterns, leading to more effective critical thinking and computational thinking skills.
7. Stay updated with advances and research in computational thinking and critical thinking education: Engage in professional development opportunities, attend conferences, and connect with other educators to exchange ideas, share best practices, and enhance pedagogical approaches around these skills.

By implementing these suggestions, educators can create an environment that supports the development of computational thinking and critical thinking skills, empowering students to navigate the complexities of the 21st century with confidence and competence.

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