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Transforming Education in the 5.0 Era: Utilizing Technology to Improve Critical Thinking and Creativity in The Digital Generation

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ABSTRACT

The Era 5.0 is marked by a significant shift towards a more human-centered society supported by technology. This transformation is occurring in various fields, including education. Education in Era 5.0 must adapt and innovate to prepare digital generation graduates who are not only proficient in digital literacy but also possess high critical and creative thinking skills. This study aims to analyze the transformation of education in Era 5.0 by utilizing technology to enhance critical and creative thinking skills in the digital generation. The research applied the Systematic Literature Review (SLR) method. Information was obtained from reputable scientific journals and filtered through searches in electronic databases such as Google Scholar and Scopus. The data were then analyzed through three steps: data reduction, data presentation, and data analysis, followed by drawing conclusions. The study's findings indicate that the utilization of technology in education can improve students' critical and creative thinking skills. Technology can enhance these abilities by helping students reflect on presented data and question its veracity and reliability. Additionally, technology can encourage students to participate in group discussions, which helps them hone their critical and creative thinking skills in developing innovative solutions or arguments. Lastly, technology can provide students with more complex and challenging tasks that require higher-order thinking. Therefore, optimal use of technology is essential in education to address the challenges of the Education 5.0 era dominated by the digital generation.
Keywords: Era 5.0, Critical thinking, Creativity, Digital Generation.

INTRODUCTION

Era 5.0, also known as Society 5.0, marks a major shift towards a more human-centered society supported by advanced technology (Akman & Erdirençelebi, 2024). In this era, technologies such as artificial intelligence (AI), Internet of Things (IoT), and robotics are progressing rapidly and bringing significant changes in various aspects of life, including education (Nurjanah et al., 2024). Education must adapt to the development of this era to avoid falling behind. If it does not keep up with changes, education will be left behind and unable to produce graduates who can adapt to the rapidly changing times. Graduates who are not well prepared for this era will find it difficult to face a changing world.

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Education in Era 5.0 must be able to adapt and innovate to prepare digital generation graduates who are not only proficient in digital literacy, but also have high critical and creative thinking skills. Critical thinking can be defined as thinking logically and reflectively, with a focus on making decisions about what to believe or do. Meanwhile, creativity refers to the process of producing creative products that are new (innovative) works produced through purposeful and appropriate activities (Samura, 2019).

Students' skills in thinking critically and creatively are becoming increasingly crucial in today's era of rapid advances in science and technology. These developments enable ease and speed in accessing diverse information from multiple sources and locations. The impact of this rapid change affects the fabric of life as well as the global dynamic. Without the ability to think critically and creatively, individuals will face difficulties in navigating, evaluating and interpreting the information needed to deal with the changes that occur. Therefore, critical and creative thinking skills are very important in life (Samura, 2019).

Critical and creative thinking skills have long been a learning objective, either explicitly or implicitly. However, in general, learning has not provided opportunities for students to find answers or ways that are different from those taught by educators. Existing learning rarely emphasizes the development of critical and creative thinking, because the strategies applied tend to be oriented towards analytical thinking with routine problems (Siswono, 2018). The development of critical and creative thinking skills in students is still difficult to do, so there is a big challenge to improve this ability in students.

The challenge of improving critical and creative thinking skills in students requires an approach, one of which is by utilizing technology. Technology in Education is a relatively new concept that brings various ideas and references. The main idea is to encourage each individual to develop optimally by utilizing technology, so that it is in line with the development of society and the environment (Suhadha et al., 2023). Therefore, the utilization of technology requires the right strategy to support the teaching and learning process, producing learners who are able to survive in today's digital era.

Based on these problems, researchers are interested in exploring in a study entitled “Educational Transformation in the 5.0 era: utilizing technology to improve critical thinking skills and creativity in the millennial generation”. Hopefully, the results of this research are expected to make a meaningful contribution to theoretical understanding of the development of effective educational strategies and policies. In addition, this research aims to encourage the development of more comprehensive theories and models in creating innovative learning tools and resources, in order to improve the quality of learning and learning outcomes of today's millennial generation. The purpose of this research is to conduct a systematic review of existing literature to evaluate the utilization of technology to enhance critical thinking and creativity in the digital generation in the current 5.0 education era.

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RESEARCH METHOD

The research applied the Systematic Literature Review (SLR) method. SLR is a method that takes a structured approach to identifying, assessing, and synthesizing all relevant evidence in the scientific literature on a particular research topic (van Dinter et al., 2021). The literature search process is conducted through academic databases such as Scopus and Google Scholar using relevant keywords. The data collected in this study met several inclusion criteria, including having to be written in Indonesian or English and published in the 2014-2024 timeframe. The following is an overview of the PRISMA diagram that describes the flow of research and the results that will be used, according to the criteria that have been set:

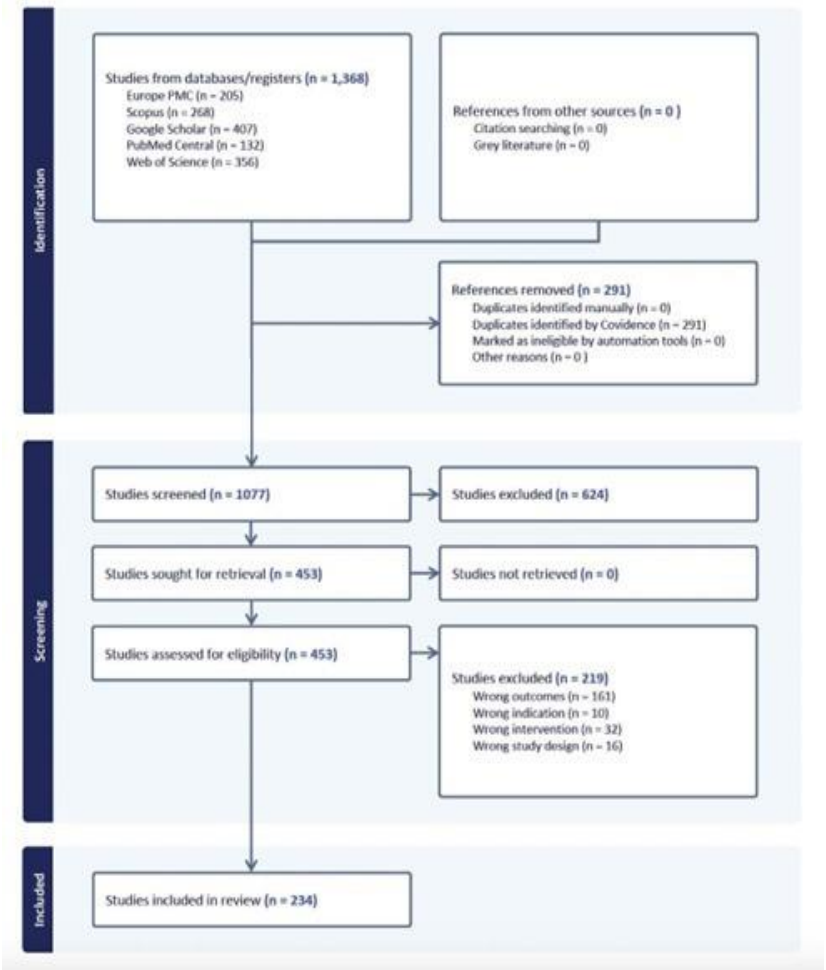

Figure 1. Prism diagram

After data collection, the analysis is carried out in the next three stages: data selection, data presentation, then finally making conclusions.

RESULTS AND DISCUSSION

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Based on the predetermined criteria, a critical analysis was conducted on the 10 research results sampled in the literature review. This review focuses on changes in education in the 5.0 era by utilizing technology to improve critical thinking skills and creativity in the digital generation, which are summarized in Table 1 below:

Table 1. Research results

No	Researcher and year of study	Research Results
1.	Legi, H., Damanik, D., & Giban, Y. (2023)	The results show that the utilization of technology in teaching and learning is vital in the current 5.0 era, where education has undergone a transformation in learning and teaching methods. Various approaches such as individualized learning, game-based learning, virtual and augmented reality, online learning media, integration of the Internet of Things (IoT) for teaching, and digital upskilling, have provided great benefits to learners, teachers, and the education system. These benefits consist of individualized learning, the possibility of broad and flexible access to education, immersive and interactive learning experiences, enhanced collaboration and communication skills, development of relevant digital skills, and readiness for change in a dynamic work environment.
2.	Sholikh, M. N., Sulisworo, D., & Maruto, G. (2019)	Findings from the study show that the utilization of technology in learning methods has an impact on improving students' critical thinking skills. Students who engaged in cooperative learning through Google Classroom platform tended to show more significant improvement in critical thinking skills after the learning process compared to students who received conventional learning directly.
3.	Muthmainnah, Ibna Seraj, P. M., & Oteir, I. (2022)	Based on the research results, the application of artificial intelligence (AI) technology in improving students' critical thinking skills has been shown to have a positive impact. Through individually tailored instruction using AI, students experienced improvements in self-confidence, belief in their own abilities, open-mindedness, and level of maturity in using English. Demonstrating the benefits of technology in helping students hone their critical thinking skills, which is recognized as a critical foundation skill for the 21st century.
4.	Al-Zahrani, A. M. (2015)	The research findings show that the use of the flipped classroom model by utilizing e-learning technology can improve students' ability in terms of creativity, especially in the aspects of fluency, flexibility,

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		and innovation. The students see this flipped classroom approach as a method that can meaningfully encourage students' creativity skills.
5.	Baskoro, G., Mariza, I., & Sutapa, I. N. (2023)	Classroom research has shown that artificial intelligence (AI) technology is effective in improving critical thinking skills for Generation Z, especially when artificial intelligence (AI) is used to check and validate student understanding, this research highlights the importance of controlling the use of AI in the learning process directly, especially at the exploration stage, to improve students' critical thinking skills.
6.	Wei, X., Weng, D., Liu, Y., & Wang, Y. (2015)	This research introduces a teaching approach that utilizes augmented reality. This approach is based on a pattern that emphasizes encouragement, peer interaction, and creativity calculation patterns. Within this framework, two teaching tools are introduced: "AR Creative-Classroom," which provides relevant knowledge in the field of creative design learning and "AR Creative-Builder," which assists students in creating realistic AR scenes. The findings in the study resulted that the proposed planned learning model can improve students' learning drive, creativity, and effectiveness in learning creative design subjects.
7.	Priadi, M. A., & Riyanda, A. R. (2021)	The findings in this study show that technology in the lesson delivery pattern that utilizes e-learning as its base can affect students' critical thinking skills applied to ecosystem lessons. The results of the study prove that this learning pattern is effective to improve students' critical thinking skills to enhance their understanding and analysis of ecosystem learning concepts.
8.	Hermansyah, H., Gunawan, G., & Herayanti, L. (2017).	The research shows that there are differences in students' concept mastery and creative thinking skills regarding vibration and wave materials when using virtual laboratory technology. From these findings, it can be concluded that the use of virtual laboratories has a positive impact on students' mastery of concepts and creative thinking skills in learning vibration and wave materials.
9.	Vari, Y. (2021)	The research found that Augmented Reality (AR) technology has benefits as a direct and real interactive learning media, encouraging students to imagine. The use of Augmented Reality learning media is proven to increase students' interest in learning. In addition, this learning media can train 21st century thinking skills, which include critical thinking skills, abstract thinking skills, and creative thinking abilities. Research shows that the use of Augmented Reality is

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		effective in training students' thinking skills, especially in science learning.
10.	Kong, S. C. (2014)	This study involved 107 students from four classes in Secondary 1 in Hong Kong during a 13-week teaching trial period. In this trial, each student was provided with a technological medium such as a tablet PC to study Integrated Humanities learning. The results of the initial and final tests related to the two topics studied showed a statistically significant improvement in students' understanding of the material. In addition, through three tests related to information literacy and critical thinking skills conducted during the teaching period, there were statistically significant improvements in students' information literacy and critical thinking skills. Interviews with learners and educators showed that they positively evaluated the design of effective pedagogical skills through digital classrooms to improve learners' information literacy and critical thinking skills.

In the Society 5.0 era, the field of education requires human resources to have specific competencies, including the ability of deep understanding, critical thinking, effective collaboration, good communication, innovation, careful problem solving, mastery of information technology, and life and career skills (Abidah et al., 2022). These skills are essential for adopting, managing and interacting with technology and collaborating with others. This set of skills is key to achieving optimal outcomes in the face of the emergence of new technological revolutions and capitalizing on these new innovations.

Critical thinking and creativity are essential abilities that students must have in this era. Critical thinking is a high-level thinking skill that is essential in developing 21st century abilities. Every individual needs critical thinking ability to successfully tackle complex problems in their lives, which involves analyzing and evaluating situations to make important decisions (Rahardhian, 2022). Furthermore, critical thinking can be strengthened by incorporating several habits, among which is creativity. Creativity is the ability to generate new ideas. When someone thinks critically, they often unconsciously also involve creative thinking skills to solve the problem at hand.

Critical and creative thinking skills are becoming increasingly important in the Society 5.0 era, where educational challenges are becoming more complex. In this era, technology offers greater connectivity between humans, machines and even between machines themselves. This can open the door to the development of systems that are smarter, adaptable and able to interact with the environment more efficiently. Some of the key technologies in the 5.0 era include the Internet of Things (IoT), Artificial Intelligence (AI), Robotics, 3D Printing, and Augmented Reality (AR) (Fricticarani et al., 2023). Students who have the ability to think critically and creatively will be

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able to better face and utilize the potential of these technologies, as well as overcome the complex challenges that arise in their education and life processes.

However, the fact is if the ranking of critical thinking skills of students in Indonesia is still in a concerning category with a low level. They have difficulty in understanding facts, complex concepts, and procedures, and applying knowledge to solve problems (Priadi & Riyanda, 2021). Therefore, various ways are sought to improve students' critical thinking skills and creativity, one of the strategies that can be used is by utilizing technology. Technology refers to all tools, machines, systems, and processes used to create, process, and convey information or materials. It includes products such as electronic devices, software, communication networks, and robotics. Technology is all things related to the development and application of tools or systems to facilitate work or solve problems in various fields (Sarnoto et al., 2023).

In line with research (Fricticarani et al., 2023), revealed that the learning approach in the era of technology 5.0 must emphasize the use of technology as a means to improve the quality of learning and provide more effective solutions for society. The utilization of technology in learning is positioned as a learning resource developed by educators. Learning resources combined with technology can create a pleasant learning atmosphere and stimulate students' creative thinking skills, which in turn encourages students to be more active in learning. This makes the classroom atmosphere more dynamic and students are more motivated in participating in learning, because they can develop their own creativity (Hermansyah et al., 2017).

According to (Ashadi & Suhaeb, 2020), the use of technology-based learning applications in facing the Society 5.0 era can benefit teachers and students by deepening the learning process. The benefits are felt by both students and teachers, because it can help in managing assignments, sharing materials, and assessing student work outside of class hours or wherever they are, without being bound by time constraints or class schedules. Student learning outcomes can then be seen from the abilities they gain after experiencing the learning process. This learning experience can include the use of various new learning media that support the achievement of learning objectives optimally.

The utilization of technology in education can be an effective tool to improve students' critical thinking skills and creativity if applied appropriately. The following are some ways in which the use of technology can help students have critical and creative thinking skills, cited in (Sarnoto et al., 2023). First, the use of technology helps students to reflect on the data provided and ask questions about its truth and reliability. Thus, helping students hone their critical and analytical thinking skills carefully. This means that the use of technology provides opportunities for students to evaluate information critically and reflectively, deepening students' analytical and reasoning skills carefully.

In addition, technology can also invite students to engage in group or class discussions on topics that are relevant to the data generated with the help of technology. Such discussions help students to hone their critical and creative thinking skills in coming up with innovative solutions

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or arguments. Technology facilitates student interaction in discussions that encourage them to think critically and come up with creative new ideas. Finally, technology can provide students with more complex and challenging tasks that require higher order thinking. This will provide benefits for students to improve critical and creative thinking skills with using technology as a learning tool.

Based on these findings, it can be concluded that the use of technology in education can improve students' critical and creative thinking skills, which are essential to face the challenges of the Education 5.0 era dominated by the digital generation. To optimize this, the role of teachers is important in providing support and valuing creative ideas and innovative solutions generated by students. This approach will also help students develop their public speaking skills. Thus, teachers can assist students in optimizing their creative potential and improving their critical thinking skills through the application of technology in learning.

CONCLUSION

The utilization of technology in the field of education is very important to respond to the ongoing changes in the current era. Critical thinking and creativity are important skills that students should have. One way to improve these abilities is by utilizing technology. The use of technology can help students reflect on the data presented and ask questions about its truth and reliability. It can also encourage students to participate in group discussions, which helps them hone their critical and creative thinking skills in coming up with innovative solutions or arguments. Finally, technology can provide students with more complex and challenging tasks, which require higher-order thinking. Therefore, the optimal use of technology is essential in education to face the challenges in the Education 5.0 era which is dominated by the digital generation.

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