International Journal of Technology and Computer Science
Vol. 1, No. 1 August 2025
e-ISSN: xxxx-xxxx; pp.38-50
DOI: https://doi.org/xx.xxxx
Available online at: *https://journal.uimandiri.ac.id/index.php/ijtcs*

Analysis of the Effect of Using Artificial Intelligence on Critical Thinking Power of Students in the Digital Age

Zeliya Arifa Hulmi[1*], Eko Aziz Apriadi[2]
[1 2] Universitas Indonesia Mandiri, Indonesia,
Email: zeliyaarifahulmi17@gmail.com

Abstract. *This study examines the effect of digital technology utilization in the learning process on students, especially in developing critical thinking, analytical, and creativity skills. Technological innovations provide various conveniences, such as more focused presentation of materials, learning systems that adjust to individual needs, and automatic responses that support understanding. However, findings show that over-reliance on such technology can inhibit independence of thought, reduce analytical power and creativity, and increase the risk of violating academic integrity. Therefore, the integration of technology in education needs to be done in a balanced manner, so that the benefits continue to support the development of students' thinking competencies amid the challenges of the times.*

Keywords *Artificial Intelligence (AI), Critical Thinking, Student Creativity, Impact of Educational Technology, AI Dependency.*

INTRODUCTION

The rapid development of information technology in the 21st century has brought tremendous convenience in accessing information quickly. However, this convenience also presents serious challenges, such as the spread of hoaxes and misinformation, which require critical thinking skills to filter out. These critical thinking skills are very important in education, especially in the digital age, which is saturated with information. One factor contributing to the enhancement of students' critical thinking skills is the utilization of artificial intelligence and good digital literacy (Putri Andani & Friyatmi, 2025).

In line with this, Ibad, Yazid, and Farhan (2024) emphasize that the use of artificial intelligence, such as ChatGPT, is becoming increasingly widespread in the learning process because it can provide instant feedback, analyze students' learning needs, and enhance creativity and collaboration. Although AI offers many conveniences, challenges remain, particularly regarding the authenticity of work, dependence on technology, and the ethics of its use. Therefore, it is important to conduct a literature review to comprehensively understand how AI influences learning

Received: January 2, 2025; Accepted: July 28, 2025; Published: August 4, 2025
*Corresponding author: zeliyaarifahulmi17@gmail.com

outcomes, critical thinking skills, and the development of students' potential in the digital age.

The rapid advancement of technology in today's digital era has brought great changes in various fields of life, including education. One of the most pronounced changes is the way students learn and interact with learning materials which are now heavily influenced by advanced technology. This paper aims to thoroughly review how the use of technology affects students, especially in relation to their ability to think, analyze, create, and how they shape their daily learning patterns.

The main reason for conducting this study is that more and more educational institutions are beginning to adopt modern technology in the teaching and learning process. On the one hand, this brings many benefits: learning becomes more efficient, materials can be accessed at any time, and the learning process can be tailored to the needs of each individual. However, on the other hand, there are also concerns. Too much reliance on technology can make students lose their independence of thought, less able to analyze in depth, and more prone to behaviors such as copying or plagiarizing the work of others. Therefore, it is important to fully understand the good and bad effects so that it can be used more wisely.

This paper is compiled based on various previous research references that use the literature study method systematically. Some also used survey and mixed approaches to find out directly the views of students on the impact of technology use in their learning activities. In this way, this study brings together diverse findings to provide a complete and balanced picture.

In general, technology does help speed up the learning process and facilitate academic tasks. However, if used without clear boundaries, it can weaken students' ability to think critically, analyze, and innovate. In addition, the increased risk of plagiarism and the decline in the spirit of independent learning are things to watch out for. Therefore, this article emphasizes the importance of applying technology wisely in education, so that it continues to support the formation of intellectual abilities and academic values that are important for students in the future.

In addition to supporting the development of critical and collaborative thinking skills, artificial intelligence also has a significant impact on students' overall mindset. Research shows that students who actively utilize AI in their learning process tend to have a more open, adaptive, and reflective mindset. This indicates that AI can be a catalyst for the growth of a smart mindset, where students believe that their abilities can continue to develop through consistent, technology-based learning processes. Through features such as automatic feedback, material customization, and instant data analysis capabilities, AI encourages students to independently evaluate and adjust their learning strategies. However, not all of its impacts are positive. Overreliance on this technology can actually reduce independent thinking initiatives and risk weakening students' analytical and creative abilities. In the context of group learning, AI has proven to help students understand the roles and contributions of each member, but challenges arise when technological capabilities among members are uneven. Therefore, it is important to ensure that the use of AI is balanced and accompanied by appropriate learning approaches, so that this technology truly functions as a tool, not a replacement for the thinking process itself (Muhammad Faisal, 2024).

LITERATURE REVIEW

This Literature Review is designed to critically review various research results related to the impact of machine logic-based digital technologies in higher education, especially in shaping students' thinking and learning. Rather than simply presenting a summary of the findings, it aims to thoroughly evaluate, reorganize the main ideas, and present a comprehensive view of how artificial intelligence plays a role in today's classrooms and encourage further research.

The literature reviewed generally describes it as an important factor in driving the transformation of learning. Several sources show that algorithm-based systems have facilitated access to materials, increased learning efficiency, and created learning experiences that are more tailored to individual needs. They support flexible teaching, enable the analysis of learning patterns, and open up access to education more widely.

A number of studies have noted a link between the use of these technologies and improvements in some thinking skills. For example, some studies report an increase in

flexibility of thinking and reflective decision-making skills when students utilize digital technology as a support in the learning process. In certain contexts, these technologies are even considered to broaden students' perspectives on a topic.

However, not all results show a favorable impact. Most researchers also highlighted concerns about the overuse of these technologies. Among them:

- Decreased ability to think deeply and analytically, as students tend to look for instant answers instead of reasoning independently.
- Decreased creativity, due to the habit of accepting results from the system without going through the process of creating original ideas.
- Increased tendency to plagiarize, due to the ease of accessing and copying content without a deep understanding process.
- Decreased motivation for active learning, as the ease of technology can make students passive in the academic process.

These findings show that, while technology provides convenience, its use also risks weakening the thinking skills that should be honed in college.

Some study results seem contradictory, some mentioning an increase in critical thinking, while others actually show a decrease. This difference could be caused by:

- The way the technology is used, whether it is just to help generate ideas or to replace the thinking process completely.
- The type of research approach, be it qualitative, or combined, which can affect the results and focus of the analysis.
- Contextual background, such as the type of course, the difficulty of the assignment, and the mental and intellectual readiness of the students themselves.

While much research has been done, there is still a void in terms of tangible solutions. Many studies only outline the impact, but not many offer concrete teaching approaches or methods that can bridge the gap between utilizing technology and training deep thinking skills. There is also limited long-term research, which is important to see the effects over a longer period of time. In addition, ethical aspects such as system bias and data security have not been touched upon in depth.

Based on this review, it is clear that artificial intelligence has become an integral part of modern education. However, to be truly beneficial, its use must be carefully directed and measured. Future approaches to education need to emphasize that tools are not a substitute for the thinking process, but rather a partner to be used consciously and critically. The way forward is not just to detect impact, but to seek and test effective teaching strategies so that technology supports, rather than undermines, students' intellectual capacity.

METHODS

To further examine the impact of smart technology use on students' mindset, especially in the context of critical thinking and creativity, this research uses a systematic literature review approach. This approach allows researchers to collect and review various sources in a structured and thorough manner, so that the results of the study obtained are not only broad in scope, but also scientifically accountable. The choice of this method was also based on the need to understand the trends, gaps and views that developed from previous studies in a more focused manner.

The initial step was to explore scientific journals and publications using relevant keywords, both in Indonesian and English, such as: artificial intelligence, critical thinking, creativity, students, impact of educational technology, and other related terms. The search focused on publications from the last five years (2020-2025), to ensure that the study was sourced from research that is still contextual to the current state of education.

In order to keep the discussion focused, the researcher set several criteria in selecting the articles to be reviewed. The articles selected must directly discuss the influence of technology on students' thought processes, be published in credible scientific journals, be available in full text, and have clearly explained methods, whether qualitative, quantitative, or combined.

Articles that only discussed the technical side of technology without linking it to education, were not scholarly articles (such as free opinion or popular news), or were duplicated from other sources, were not included in this review.

Once the articles were collected, the researchers screened them through systematic stages. This started with reading the titles and abstracts to assess initial relevance, followed by a full reading to ensure content alignment with the research focus. Only articles that met all the criteria and were considered to make a real contribution to the topic were included in further analysis.

From the selected articles, the researcher noted key points such as the purpose of the study, the approach used, the characteristics of the respondents (if any), and the results and conclusions directly related to the influence of technology on students' thinking skills. The information was then classified to facilitate the process of grouping and comparing findings.

The analysis process was conducted using a thematic approach. The researcher explored patterns that emerged from the various studies, identifying similarities, differences, and contradictions in the findings. In addition, factors that may have influenced the differences in results, such as the methods used, the context of the research, or the focus of the variables raised, were also examined. Not only does the study review positive impacts such as learning efficiency and easy access to information, it also highlights risks such as a decline in the quality of critical thinking, a tendency to plagiarism, and weak motivation to think independently.

RESULTS

This section presents the synthesized results of the literature review that has been conducted systematically. The aim is to summarize the findings of a number of studies that discuss the impact of smart technology on the way students think in the digital era. The review not only presents the common ground among the researchers, but also highlights the different perspectives and nuances that emerged in the various study contexts, which together provide a strong foundation for understanding the issue under study.

The articles analyzed in this review include recent scholarly works, most of which focus on the application of smart technologies in higher education settings. The approaches used are diverse-from in-depth literature studies, to quantitative surveys, to

qualitative or combined approaches-allowing researchers to look at the topic from multiple angles and generate a more thorough understanding.

In general, many studies show that these technologies can bring real benefits to student learning. Some studies reveal that digital tools, such as automated text-based systems, can speed up information access and help students complete academic tasks more efficiently. In addition, these technologies also encourage more personalized learning, as they can tailor materials to individual needs and provide immediate feedback. In fact, in some cases, the use of this technology is associated with an increase in students' critical thinking skills, especially when it is used in a directed manner and does not replace the thinking process itself. The flexibility of students' thinking also tends to increase as they are encouraged to explore different approaches and perspectives.

However, there are also many studies that highlight the flip side of overusing this technology. One of the main concerns is the tendency for students to become overly dependent on the system, thus weakening their initiative in analyzing problems or developing ideas independently. When students only follow automatically generated answers, their creativity and innovativeness can be stifled. Some reports also mention that students become less motivated to look for primary references or deepen their own understanding, because they are satisfied with what the system presents. Furthermore, there is an increased risk of plagiarism, mainly due to the ease of generating text or answers without actually understanding the content or citing sources appropriately.

The differences in findings from one study to another show that the impact of this technology is not absolute. In some cases, positive outcomes emerge when technology is used as a support for active learning. Conversely, when the system is used entirely to replace the thinking process, negative effects are more likely to occur. Other factors such as methodological approach and student engagement in the learning process also influence the final outcome.

Overall, the results of this study lead to one important conclusion: technology cannot be separated from modern learning, but its use needs to be aligned with pedagogical principles that emphasize the development of thinking skills and academic

responsibility. The use of technology should be a tool that supports learning, not replaces it. There are also ethical issues, such as data protection and potential system bias, that need to be considered when using technology in education.

DISCUSSION

This section further explores the findings obtained from the systematic literature review on how artificial intelligence-based technology impacts on students' critical thinking skills amidst the advancement of education today. The main focus of this study is to thoroughly describe the positive and negative impacts of these technologies on higher order thinking skills. The main contribution of this study lies in presenting a balanced and incisive view of the existing literature, highlighting the complex relationship between modern technologies and students' intellectual growth, while suggesting ways to utilize them responsibly.

The results show that smart digital technologies play a dual role in the learning process. On the one hand, they speed up access to information, help organize assignments, and provide a learning experience that is more tailored to the needs of individual students. This is in line with the initial expectation that technology can be a tool that enhances academic activities. However, on the other hand, the tendency to rely too much on these systems can reduce the intensity of independent thinking, weaken creativity, and pose a risk of plagiarism and passive learning habits. These findings are in line with the direction of the research question, which seeks to examine the broad and deep influence of technological advancements on today's students.

Most of the results found are in line with concerns that have been voiced by many researchers before. Some of the studies reviewed suggest that uncontrolled use of technology risks disrupting thought processes and innovation. However, interestingly, there are also studies that see the positive side, for example, the use of digital systems to support critical thinking, especially when technology is used to provoke ideas or organize arguments, rather than replacing the thinking process itself. The differences in results are likely due to the way the technology was used, the different methodological approaches, and the different backgrounds of the study participants.

The findings provide a number of important messages for educators and educational institutions. For digital technology to be truly beneficial, several steps can be considered, such as:

- Improving students' understanding of the technologies used, including their potentials and limitations, so that they are able to use them wisely and not get caught up in overuse.
- Adjusting the curriculum and teaching methods, by integrating technology as a support for learning activities, not as a substitute for students' thinking skills. Learning approaches need to be geared towards encouraging students to evaluate the outcomes of technology and form original ideas.
- Emphasize essential skills that cannot be replaced by machines, such as reflective thinking, complex problem solving, communication skills, and teamwork.
- Establish clear and ethical rules for the use of technology, especially in the context of assignments and scholarly work, to maintain academic integrity.

While this study succeeds in providing a comprehensive overview, there are some limitations that should be noted. First, the sources used rely heavily on documents that were available and accessible at the time of the study. Secondly, there is a possibility of publication bias, where only studies with "interesting" or trending results are published. Thirdly, different definitions of critical thinking and creativity between studies may affect the meaning of the analysis. And finally, as this study is literature-based, no primary data was collected directly from respondents.

Given the limitations and gaps in the existing research, some directions for future research include:

- Long-term studies to monitor the impact of technology on the development of students' thinking over a period of time.
- Experimentation with new teaching approaches, to find out which methods are most effective in combining technology and thinking skills training.
- Qualitative research based on students' experiences, to explore how they interpret their interactions with technology in their daily learning lives.

- Cross-cultural studies, which compare the application of technology and its impact in educational environments from different countries or academic systems.
- Ethical and realistic policy development, which regulates the use of technology in education without limiting students' creativity or intellectual exploration.

From the overall discussion, it is clear that smart technology can be a valuable asset in education if used appropriately. However, if addressed without wise direction, its existence has the potential to disrupt the learning process that is actually aimed at shaping independent and critical thinking. Therefore, both institutions, teachers, and students themselves need to play an active role in building smart and balanced patterns of technology use. Thus, technology is not only a tool, but also a partner in creating more adaptive, reflective and creative learning in this digital era.

CONCLUSION

Through a systematic literature review, this study concludes that the use of smart technology in education has a broad and complex impact on the way students think, especially in the aspect of critical thinking. On the one hand, various findings show that these technologies are able to accelerate the learning process, support more personalized learning, and expand access to information and reference sources. All of this certainly provides meaningful support in students' academic activities.

However, there is also a serious concern. Excessive reliance on such technology has the potential to weaken the ability to think independently, inhibit analytical power and creativity, and foster a tendency to imitate without thinking. Risks such as plagiarism and decreased motivation to learn actively are important issues that are highlighted in many of the studies reviewed.

Although some studies show seemingly conflicting results depending mainly on how the technology is used and in what context, the majority of the literature agrees that the successful use of technology in education lies not only in the tools, but also in the way teachers and institutions integrate them into the learning process. The real challenge is not the technology itself, but how to ensure that its use does not undermine essential thinking skills if not coupled with appropriate learning approaches and awareness of academic ethics.

As a direction for future research, it is important to conduct long-term studies that are able to monitor how the influence of this technology develops on students' thinking skills over time. In addition, the development of teaching methods specifically designed to combine technology with critical and creative thinking training is also an urgent need. For educators and policy makers, the results of this study serve as a reminder that students need to be equipped with not only technical skills in using technology, but also the skills to think independently, reflectively and responsibly, skills that are needed to face the challenges of education in this digital era.

LIMITATION

As with any scientific study, this research has limitations that need to be openly acknowledged. Identifying limitations is not just a formality, but an important part of maintaining scientific honesty and providing a proper context for the interpretation of results and the direction of future studies.

As this research is based on a literature review, all analysis relies heavily on scholarly documents and articles available in the academic databases used. This means that the quality and completeness of the findings presented are influenced by the extent to which relevant sources can be accessed, particularly those contained in the set of PDF documents analyzed. If there are important studies that have not been published or are not available in the sources reviewed, they are automatically excluded from the discussion. This can certainly limit the scope of understanding the influence of technology on the mindset of students.

The possibility of publication bias is also something to look out for. Studies with results that are considered "interesting" or support the general view tend to be more easily published, while studies with insignificant or contradictory results may escape publication. This imbalance can create a less than fully objective picture of the topic at hand, and has the potential to disproportionately emphasize one side of the positive or negative impacts of technology.

The articles analyzed in this study used different approaches, both in terms of methods and in defining key concepts such as "critical thinking", "analysis" and "creativity". In addition, there were variations in the type of technology used, the

characteristics of the participants, and the institutional context of each study. These differences make it difficult to directly compare results and draw generalizable conclusions. Therefore, generalizations to all students or all forms of technology use need to be made with caution.

This study specifically highlights the influence of technology on students' thinking skills, especially in cognitive aspects such as analysis, creativity and problem solving. With this fairly narrow focus, other aspects of technology use in education such as its impact on campus management systems, educator training, or ethical challenges beyond the cognitive context were not part of this study. This means that although this study provides a deep insight into the dimensions of students' thinking, it does not reflect the overall effect of technology utilization in education.

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