International Journal of Social and Education (INJOSEDU) e-ISSN: 3047-6151
Vol. 2 No. 1 January 2025, hal., 104-124

TECHNOLOGY AND COGNITIVE SKILLS: INTEGRATING MODERN EDUCATION TO CREATE A GENERATION OF CRITICAL THINKERS

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Abstract

In today's digital age, technology integration in education has significant potential to develop students' cognitive skills and shape a generation of critical thinkers. The use of innovative educational tools and applications can stimulate analytical thinking, problem-solving and creativity. Technology offers a range of interactive tools that can be customised to students' skill levels, allowing for more individualised and effective learning. However, the application of technology in education also presents challenges that need to be overcome. Issues such as disparities in access to technology, varying digital skills among teachers, as well as the disruption that technology use can cause in the classroom, necessitate appropriate strategies and policies. Inclusive programmes that provide equitable access to tools and training, as well as improving teacher competencies through continuous training, are important steps to overcome these barriers. Ultimately, the successful integration of technology in education depends not only on the availability of technological devices, but also on how they are used to transform teaching and learning methods. A comprehensive approach involving active and collaborative learning, and a focus on developing critical and creative thinking skills, will create a more dynamic and empowering learning environment for students. As such, technology can be a major catalyst in the effort to create a generation ready to face future challenges with superior cognitive skills.

Keywords: Technology, Cognitive Skills, Integration, Modern Education, Generation of Critical Thinkers.

Introduction

Since the Industrial Revolution 4.0 era, technology has become an integral part of everyday life, both on an individual scale and on a wider community scale. The rapid advancement of technology has brought significant changes in various aspects of life, including in the field of education.

The adoption of technologies such as adaptive learning software, educational mobile apps, e-learning platforms, and digital collaboration tools has changed the way teaching and learning is done. These technologies allow for more personalised and interactive learning, allowing students to learn at their own pace and learning style. (Sitopu et al., 2024); (Fawait et al., 2024); (Syakhrani & Aslan, 2024).. In addition, the use of technologies such as virtual reality (VR) and augmented reality (AR) in education provides a more immersive and motivating learning experience, allowing students to explore complex concepts through engaging simulations and visualisations. The implementation of technology also supports greater access to information and learning resources, eroding geographical boundaries and providing more inclusive learning opportunities. (Thornhill-Miller et al., 2023)..

The utilisation of technology in education has opened up new opportunities to develop students' cognitive skills and create a generation of critical thinkers who are ready to face future challenges. However, despite the widespread adoption of technology in education, many challenges remain. One of the main challenges is how to ensure that the use of technology not only accelerates access to information, but can also actually improve students' cognitive skills and critical thinking ability. Many schools and educational institutions have not fully succeeded in integrating technology effectively in the learning process. (Kennedy & Sundberg, 2020).

Cognitive skills, such as critical thinking, problem solving, creativity and adaptability, are becoming increasingly important in an increasingly complex and competitive world. To produce a generation capable of critical thinking, it is not enough to simply provide state-of-the-art technology in the classroom. A holistic approach that combines technology with innovative and relevant pedagogical strategies is required. (Obidovna, 2024).

Research shows that appropriate use of technology in education can increase student participation, provide more interactive learning experiences and develop 21st century skills. However, without clear guidelines and objectives, technology will only be a passive tool that does not provide maximum benefits for students' cognitive development (Dwyer & Walsh, 2020).

Therefore, it is important to explore and implement models of technology integration in education that are effectively designed to support cognitive skills. Modern education should endeavour not only to improve students' digital literacy, but also to equip them with critical thinking skills that will be an important asset in their future professional and personal lives.

Research Methods

The study in this research uses the literature method. The literature research method, or often referred to as literature study, is a research approach that collects, reviews and analyses written works relevant to a particular research topic. The aim is to

identify, evaluate, and synthesise findings from various sources, such as books, journals, scientific papers, and other articles, in order to gain an in-depth understanding of the issue or phenomenon under study. (Setiowati, 2016); (Syahran, 2020). Literature research helps researchers build a strong theoretical foundation, identify research gaps, and avoid duplicating existing studies. The process involves stages such as searching academic databases, screening relevant sources, and critically analysing the content found. By relying on secondary sources, the literature research method is able to provide a broad and in-depth perspective without the need for primary data collection, making it very effective in building arguments and scientific validation in a study. (Helaluddin, 2019).

Results and Discussion

Integration of Technology and Cognitive Skills and Critical Thinking

Cognitive skills are mental abilities used to process information, understand things, learn, and solve problems. These skills include various brain functions involving thinking, memory, comprehension, analysis, evaluation, and concept formation. (Fang et al., 2021). Cognitive skills enable individuals to adapt to their environment, make informed decisions, and solve problems effectively. Examples of cognitive skills include focusing ability, memory ability (short-term and long-term memory), analytical ability, problem-solving ability, and cognitive flexibility. (Islam et al., 2024).

Critical thinking is one of the important components of cognitive skills that involves the ability to think clearly and rationally, and understand the logical relationship between ideas. The components of critical thinking include several key elements, including: problem identification and clarification, gathering and evaluating relevant information, analysing arguments and evidence, reflecting on underlying assumptions, drawing appropriate and logical conclusions, and developing strategies to solve problems. Individuals with strong critical thinking are able to objectively assess arguments, identify biases and errors in reasoning, and develop creative and effective solutions. (Pacheco, 2020). Critical thinking is important in various aspects of life, including in decision making, problem solving, and strategic planning, so it is an invaluable skill in facing the challenges of the modern world. (Syzdykova et al., 2021)..

The integration of technology in the development of cognitive skills and critical thinking has become a major focus in this digital era. Technology serves not only as a tool, but also as a medium that can stimulate and expand an individual's cognitive abilities. For example, computer programmes and technology-based learning applications can improve memory and concentration skills through structured and interactive exercises. In addition, technologies such as Virtual Reality (VR) and Augmented Reality (AR) can be used to create immersive and realistic learning environments, thereby enriching the learning experience and enabling the exploration

of complex concepts in a more intuitive and practical way. (Judijanto et al., 2024); (Iksal et al., 2024); (Sartika & Fransiska, 2024)..

The ability to think critically can also be strengthened through the use of technology. Data analytics applications, for example, allow users to gain insights from big data and make decisions based on measurable evidence. With tools like these, users can more easily identify patterns, analyse trends, and predict outcomes based on available data. Technology can also encourage more effective collaboration and discussion between individuals through digital communication platforms, which in turn can broaden their perspectives and critical thinking. Online discussions and debate forums, for example, allow students or professionals to sharpen their arguments and learn from others' points of view (Mhlongo et al., 2023)..

In addition, technology-based learning offers flexibility and accessibility that was previously unattainable. E-learning and online courses allow individuals to learn at their own pace and time, which is highly beneficial to the development of cognitive skills and critical thinking. The use of multimedia, including interactive videos, training modules and simulations, can make the learning process more engaging and effective. Thus, technology-based learning can tailor teaching methods to the needs of each individual, thus enabling them to develop analytical and critical thinking skills according to their own learning styles. (Susnjak & McIntosh, 2024)..

Finally, the utilisation of technology in education and training also demands the importance of digital literacy. This means that individuals not only need to understand how to use software and hardware, but also need to be able to assess the credibility of information sources, understand digital ethics and manage their digital identity. Good digital literacy skills support the ability to think critically about information found online, identify bias, and make thoughtful judgements regarding the reliability and validity of such information. Ultimately, the integration of technology in the development of cognitive skills and critical thinking leads to a generation that is more competent and ready to face the challenges of an ever-evolving world. (Moraiti et al., 2022)..

Thus, the integration of technology in the development of cognitive skills and critical thinking has enormous potential in enhancing individuals' capacity to learn and think more deeply. Technology not only facilitates the learning process through interactive tools and immersive environments, but also encourages collaboration and data analysis that supports evidence-based decision-making. With the flexibility and accessibility offered by technology-based learning, individuals can develop skills at their own pace and needs, making this process more personalised and effective. However, it is important to remember that digital literacy is a crucial component of technology utilisation, enabling individuals to assess and utilise information wisely. Through proper integration, technology can shape a generation that is better prepared and competent in facing the complex challenges of the future.

Effective teaching techniques to improve critical thinking skills

Effective teaching techniques to improve critical thinking skills firstly include the application of active and collaborative learning methods. For example, using small group discussions or debates in class allows students to express their opinions, listen to other perspectives, and hone analytical skills. When participating in these discussions, students are encouraged to support their arguments with evidence and sound reasoning, as well as identify and evaluate the assumptions underlying a point of view. In this way, students learn to not only passively receive information but also to critically assess and reflect on what they learn. (Nusantari et al., 2021)..

Furthermore, the use of case studies and real-world problems is proven to be effective in building critical thinking skills. This technique allows students to apply the theories and concepts they have learnt in a practical context, which encourages analytical thinking and problem solving. (Ramankulov & Zaytseva, 2023).. For example, teachers can provide case studies relevant to the subject matter and ask students to formulate solutions, predict various possible outcomes, and consider the implications of their decisions. Through this process, students learn not only academic content, but also the critical skills needed to navigate real-life situations (Gonzalez-Mohino et al., 2023)..

The application of Socratic questioning or enquiry-based teaching methods is another effective technique. In this approach, teachers ask open-ended questions designed to encourage students to think more deeply about the material being learnt. Instead of providing direct answers, these questions challenge students to develop their own understanding and formulate good arguments. For example, the teacher might ask, "What evidence supports this argument?" or "How does this concept impact a particular context?" This technique encourages active participation and allows students to explore different aspects of a complex issue, improving their critical thinking skills. (Delanty & Harris, 2021).

Finally, the integration of technology in teaching can play a major role in enhancing critical thinking skills. Digital tools, such as interactive simulations, educational games and online collaborative platforms, offer innovative ways to engage with learning materials. For example, simulations can be used to simulate complex real-world situations, allowing students to practice problem-solving and decision-making in a safe and controlled environment. These resources, when used wisely by educators, can create dynamic and immersive learning experiences that strengthen students' critical thinking skills.

Barriers and Solutions in the application of technology for Cognitive Skills and Critical Thinking

One of the main barriers in the application of technology to develop cognitive skills and critical thinking is the accessibility and infrastructure gap. Not all schools or

educational institutions have adequate access to advanced technology such as computers, tablets or stable internet connections. This can lead to inequalities in learning opportunities for students from different socio-economic backgrounds. (Wolcott & Sargent, 2021).. The solution is to develop government programmes or public-private partnerships to provide the necessary technological devices and infrastructure equally. In addition, it is also important to organise training for teachers and students on the effective use of technology in the learning process. (Jablonka, 2020).

Another barrier is the lack of adequate training for teachers in utilising technology to develop critical thinking skills. Many teachers may not be familiar with digital applications or tools that can be used for this purpose, so they tend to stick with conventional learning methods. To address this, educational institutions need to provide ongoing training programmes and workshops for educators. This training should focus on the introduction of educational technology tools as well as innovative ways to integrate them into the teaching curriculum with the aim of improving students' critical thinking skills. (Kaczkó & Ostendorf, 2023)..

In addition, policy and regulatory factors can also be barriers to the implementation of technology for cognitive and critical learning. Too strict regulations or slow bureaucracy can hinder the implementation of new technologies in the educational environment. The solution is to encourage government and stakeholder involvement in developing policies that support technological innovation in education. Holding discussions and consultations with various stakeholders, including teachers, students and technologists, can help in formulating regulations that are flexible and adaptive to the needs of technological developments in learning. (O'Reilly et al., 2022)..

Finally, an issue that often arises is the risk of distraction and disruption posed by technology. Uncontrolled use of technology can make students more easily distracted by entertainment or social media, reducing learning focus and effectiveness (Thelma et al., 2024).. To address this issue, teachers need to develop clear strategies and rules regarding the use of technology in the classroom. Creating a structured schedule for the use of digital tools and ensuring that activities involving technology are always directly related to learning objectives are some ways to go. In addition, educating students about digital etiquette and how to use technology productively is also an important step in minimising distractions. (Jalinus, 2021).

Thus, while there are some barriers to the application of technology to develop cognitive skills and critical thinking, various solutions can be implemented to overcome them. Accessibility and infrastructure gaps can be addressed with inclusive programmes that provide technology devices and equitable training. Improving teachers' competence in utilising technology can be achieved through continuous training programmes. Corrections to overly restrictive policies and regulations need to be made to support technological innovation in education. Finally, disruptions caused by

technology can be addressed with effective classroom management strategies and digital ethics education for students. With a comprehensive and collaborative approach, technology can be a powerful tool in developing students' cognitive skills and critical thinking.

Conclusion

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