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Alisa Fikriyah
Graduate Program
Yogyakarta State University, Indonesia
E-mail: alisafikriyah.2021@student.uny.ac.id
ORCID ID 0000-0002-2974-2425

Novita Nurbaiti
Graduate Program
Yogyakarta State University, Indonesia
E-mail: novitanurbaiti.2021@student.uny.ac.id
ORCID ID 0000-0002-4709-7255

Gulzhaina K. Kassymova
Abai Kazakh National Pedagogical University;
Institute of Metallurgy and Ore Beneficiation,
Satbayev University, Kazakhstan
E-mail: g.kassymova@satbayev.university

Heri Retnawati
Mathematics and Science Faculty
Universitas Negeri Yogyakarta, Indonesia
E-mail: heri_retnawati@uny.ac.id
ORCID ID 0000-0002-1792-5873

Use of technology in high school: A systematic review

Abstract: The development of technology in the field of education is growing rapidly. This systematic review aims to explore the roles, impacts, and trends in the use of technology in education. There is a total of 30 articles were met the criteria and then analyzed. The results of this study indicate technology has a positive role in facilitating appropriate learning processes and environments in high school settings. Technology-supported learning also has a positive impact on students' learning outcomes and attitudes. This study also found that augmented reality and virtual reality are learning media that are widely developed. The results of this study imply that the development of technology and the readiness of the parties involved in education can enhance the teaching-learning process more successfully.
Keywords: Technology, Senior High School, Education, Learning.

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Introduction

The 21st century is characterized by the use of technological devices in various activities (Hrastinski & Ekman Rising, 2020). The use of technology and digitization in all areas of activity and work are characteristics of this era (Jones et al., 2017; Lange et al., 2020). One of the activities or sectors that is affected by technological developments is the education sector. The rise of digital learning platforms is one proof that there has been a technological revolution for education (Knox et al., 2020; Manolev et al., 2019). These developments have an effect on improving the quality of education, especially in the learning process (Myskova, 2019; Zhai et al., 2019). In this case, education needs to adapt to technology (Marta, 2019). The use of technology in education can help students explore complex topics that cannot be achieved by traditional teaching methods (Hamilton et al., 2021).

Technology has created new potentials to facilitate learning activities (Marta, 2019). The use of information technology has reformed the teaching and learning process (Ishaq et al., 2020; Rodríguez et al., 2017). In addition, information technology also provides benefits, namely providing a teaching and learning process and a dynamic environment (Shatri, 2020). Many studies discussing the use of technology in education are growing, both the analysis of its implementation, its impact, and even the development of

technology-based products for education. For example, research on the use of technology in mathematics (Bray & Tangney, 2017), research on flipped classrooms (Akçayir et al., 2016) and the effects of using technology-based media on student achievement (Sahin & Yilmaz, 2020).

The integration of technology into education is widely accepted. The results of the study show that the integration of technology in education, especially in the learning process, can increase academic success and influence students' attitudes (Zeighner, 2020). The use of good technology tools will also be useful for students' independent learning (Zhai et al., 2019). Technology provides visualization for material delivery and can make learning meaningful in various learning environments (Dinç, 2017). In a wider scope, the use of appropriate technology is one indicator of the progress of education in a country, especially in the current era of globalization (Digdoyo et al., 2021). Meanwhile technology must be used in learning activities in secondary education institutions, for example in senior high schools or equivalent (Yilmaz, 2017). The use of technology at the high school level is expected to have an impact on classroom teaching (Hanımoğlu, 2018; Ibieta et al., 2017). Learning in high school generally aims to prepare students for a career or continue to a higher level (Hanımoğlu, 2018). The use of technology in learning in high school can increase students' motivation and independence (Goldin & Katz, 2018).

Based on the explanation above, technology is inseparable from the field of education, including learning activities. This makes the authors interested in exploring the roles, impacts, and trends in the use of technology in education.

Method

This systematic review research was conducted to review the results of studies over the past three years that examined the use of technology in education at the senior high school level. Using Okoli's systematic review stages consisting of planning, selection, extraction, and execution (Okoli, 2015). The researcher collected research results with the help of Publish or Perish. The keyword used was "technology in education". The literature screening process follows several criteria, namely 1) research articles written in English, 2) research articles published since 2019, 3) research involving senior high school students or teachers and 4) substances that can help researchers answer research questions. Through the literature search, a total of 30 articles were met with the criteria and then analyzed.

Results and Discussion

The Role of Technology in Education

One of the aims of this literature review is to identify the role of technology in education that has been reported in the last three years. Studies reported that technology has a role to assist teachers in facilitating a more appropriate learning process. Previous studies noted that technology could provide unique and interesting materials. One study's results suggest that learning environments in which augmented reality is implemented add visual and textual components to the learning process of physics for high school students (Abdusselam & Karal, 2020). Technology-integrated learning also provides accessible information at any given time conveniently specifically in drone education (Espinola et al., 2019). Some studies focusing on the effects of technology-based teaching materials in health education for high-school students also reported that technology can solve the lack of connection between education courses and daily life scenarios (Lin et al., 2021) and complement course instructions (Barsom et al., 2020). When the teaching and learning environment is user-friendly and well-planned, technological use in education can support interactive teaching (Agyei & Agyei, 2021). These results are in line with previous studies that suggested information technology provides a teaching and learning process and a dynamic environment (Shatri, 2020) and this can make learning more meaningful (Dinç, 2017). These results studies emphasized that technology plays an important role to help teachers maximize learning materials and create a suitable learning environment.

On the other hand, technology also helps teachers to navigate applicable learning methods to meet students' learning needs. The results of several studies that examine technology-based learning materials showed a positive effect in overcoming the problems to be addressed such as difficulties in mastering the subject (Ilmi, 2021), learning motivation (Lin et al., 2021), and practical learning (Bima et al., 2021).

Research and development studies that focused on integrating technology in teaching not only produce learning materials models but also learning instructions and assessments that complement overall learning processes (Hartanto et al., 2022; Ilmi et al., 2021; Novaliendry et al., 2021). It implied that there's a significant role of technology in improving teaching and learning instructions. As mentioned in previous studies, applying technology to education can help students explore complex topics that cannot be achieved in traditional teaching methods (Hamilton et al., 2021) and have potentially facilitated learning activities (Marta, 2019).

Considering the role of technology, some research findings also discuss teachers' attitudes. The research reported that some technology teachers valued the importance of technology, enjoyed teaching technology, and had confidence in their teaching (Xu et al., 2022). Research also suggested some results regarding factors influencing teacher use of technology. Teachers' technology self-efficacy was important in predicting teacher use of technology (Li et al., 2019). It is also noted that teachers' pedagogical belief is important (Li et al., 2019) and significantly influence teachers' intention on using technology in teaching (Prasojo et al., 2020). These results implied that pedagogical readiness is as important as technological readiness for teachers to integrate technology role in teaching to serve more advanced teaching purposes.

The Impact of Technology on Learning

Researchers have examined the effectiveness of various technology utilization in learning by measuring its effects on student learning outcomes. The effect of technology on learning is widely researched considering the roles of technology as mentioned above. This literature review found the effect of technology on student outcomes is including cognitive factors such as improving students' conceptual understanding (Liburd, 2021; Lin et al., 2021) and increasing their better knowledge mastery in the subject (Abdusselam & Karal, 2020; Barsom et al., 2020; Onan et al., 2019; Zhai et al., 2019). These results are in line with previous studies there is effects of using technology-based media on student achievement (Sahin & Yilmaz, 2020).

Other studies reported the effects of technology use on various domains. Studies noted the use of technology affects students' self-efficacy (Huang et al., 2020; Samsudin et al., 2020), learning motivation factors such as attention, relevance, confidence, and satisfaction (Lin et al., 2021) and delivers better presence, engagement, and empathy of students (Calvert & Abadia, 2020). In addition to having an effect on student motivation (Bao et al., 2019; Suherdi, 2019), technology also has great influence on interaction of teacher-student and student-content also student teamwork and collaboration (Marín-Marín, 2020). As previous studies mentioned, technology can increase academic success and influence students' attitudes (Zeighner, 2020)

Some studies also suggest that technology-supported learning approach could potentially better promote students' creative thinking (Huang et al., 2020; Osipova et al., 2019; Sari et al., 2020). It was also reported that technology-integrated learning design can increase high school students' awareness of certain topics such as climate change (Solís, 2019) and cervical cancer (Ampofo et al., 2020).

Learning Media

Learning media innovation is one component that develops along with technological trends in education. technology in learning media provides functional enhancement, namely involving students in learning activities and as a material to stimulate their imagination (Zhai et al., 2019). This can be used to improve the quality of students (Hanif, 2020; Sarioğlu & GIrgIn, 2020). The results of this study will discuss several learning media that are widely used today based on technology.

a. Virtual Reality
   Virtual Reality can improve students' cognitive (Calvert & Abadia, 2020; Semeraro et al., 2019). In addition, high school age students assess the use of VR both in terms of the meaningfulness of learning, visualization, and engagement (Calvert & Abadia, 2020). VR can increase self-confidence for high school students (Barsom et al., 2020).
b. Augmented Reality
   Augmented reality is used for interactive learning (Syawaludin et al., 2019). Augmented reality can present real experiences and environments in learning (Abdusselam & Karal, 2020). AR combines virtual and real-world environments and is useful for simulation-based learning (Radosavljevic et al., 2020).

Conclusions

This study describes several results related to the role of technology in education, the impact of using technology in learning, as well as learning media that has been developed over these past three years. In terms of its role, technology serves to facilitate a more appropriate learning process, provide flexible learning information and dynamic access to education. Technology also plays a role in assisting teachers to navigate learning methods that are suitable for students' needs. In terms of learning activities, technology has a positive effect on improving students' cognitive abilities, increasing self-efficacy, and fostering students' creative attitudes. Meanwhile, the development of technology-based learning media is growing. This study describes 2 technology-based learning media that are increasingly being developed, namely learning media based on augmented reality technology and virtual reality. These learning media certainly responds to students' needs regarding learning preferences from verbal and visual to virtual. From this description, it can be concluded that the integration of technology with education has a positive role and impact. The results of the study imply that the readiness of the parties involved in education needs to be balanced with the rapid advancement of technology. Technology that is utilized properly, especially in learning, can benefit teachers, students, and the success of learning.

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