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# Technology-Based Education Transformation: Futuristic, Quality, Resilient, and Sustainable Education System in the Age of Society 5.0

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## *Abstrak*

*Transformasi pendidikan digital di Indonesia belum dilihat sebagai kebutuhan layanan pendidikan masa depan menuju society 5.0. Studi ini bertujuan untuk mendeskripsikan, mengeksplorasi dan menganalisis bahwa pendidikan berbasis teknologi merupakan model baru yang urgen dalam penyelenggaran sistem pendidikan. Studi kualitatif ini difondasikan pada data sekunder hasil studi literatur. Temuan penelitian adalah integrasi teknologi digital dalam pendidikan merupakan kenyataan yang tak terelakkan untuk membangun paradigma pendidikan yang berkualitas-berketahanan-berkelanjutan. Integrasi ini dilakukan melalui proses transformasi layanan pendidikan dari ruang kelas ke dalam platform digital multifaset yang mencakup pembelajaran online, ruang kelas virtual, e-book. Transformasi ini merupakan konsekuensi perkembangan masyarakat menuju society 5.0; prevalensi generasi digital-native dan disrupsi global seperti pandemi dan krisis lingkungan hidup. Dengan demikian realitas sosial saat ini memerlukan sistem pendidikan yang adaptif-inovatif dan kolaborasi di antara para pemangku kepentingan. Kolaborasi ini memastikan terwujudnya sistem pendidikan yang selaras dengan kompleksitas lanskap sosio-teknologi masa kini dan masa depan, yang pada akhirnya memajukan inklusivitas, ketahanan, dan keberlanjutan.*

***Kata kunci*:** *Pembelajaran Digital, Generasi Digital, Transformasi Pendidikan,* Society 5.0, *Berkelanjutan*

## Abstract

The transformation of digital education in Indonesia has not been seen as a need for future education services towards society 5.0. This study aims to describe, explore and analyze that technology-based education is an urgent new model in organizing the education system. This qualitative study is based on secondary data from literature studies. The research findings are that the integration of digital technology in education is an inevitable reality to build a quality-sustainable education paradigm. This integration is done through the process of transforming educational services from the classroom into a multifaceted digital platform that includes online learning, virtual classrooms, and e-books. This transformation is a consequence of the development of society towards society 5.0; the prevalence of the digital-native generation and global disruptions such as pandemics and environmental crises. Thus, the current social reality requires an adaptive-innovative education system and collaboration among stakeholders. This collaboration ensures the realization of an education system that is aligned with the complexities of the current and future socio-technological landscape, ultimately promoting inclusivity, resilience, and sustainability.

**Keywords:** Digital Learning, Digital Generation, Education Transformation, Society 5.0, Sustainable

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## 1. INTRODUCTION

The recent global COVID-19 pandemic has shown that the transformation of the educational world is necessary (Dziubaniuk et al., 2023; Matli & Phurutsi, 2023; Ogata et al., 2023; Okoye et al., 2021; Vishnu et al., 2022). Traditional face-to-face classroom education services are unable to withstand the disruptive conditions and emergencies that occur (Iivari et al., 2020; Maryani et al., 2023; Mhlanga & Moloi, 2020). At the onset of the disruption, Indonesia's education system came to a halt; traditional face-to-face educational services could not be implemented due to social restriction policies. As a result, students graduated

prematurely without taking exams. The emergency forced the education world to transform into digital technology-based educational services. The new experience of technology-based learning processes for students and teachers elicited different reactions and responses. For some teachers, digital learning such as distance education is considered unsuitable, and they feel a loss of authority as they cannot interact directly with students.

They also struggle to teach with digital technology due to a lack of previous training and understanding. But in reality, for learners, online learning and technology are needs that must be met. They expect digital education services to continue even though social restriction policies have been abolished. This condition is caused because the current learners are dubbed the digital generation who can only interact, grow, and learn optimally if connected to the digital world (Jahromi et al., 2023; Net, Nuryadi, et al., 2023; Nuhu & Aladesusi, 2022). In addition, in the context of the 5.0 society, referred to as the super-smart society, the integration of technology in education becomes important and urgent. Thus, technology-based education has become an urgent need today, so that the goal of education to shape a high-quality young generation, improve the quality of life, and provide solutions to existing problems and challenges can be realized (Andayani et al., 2023; Khairunnisa Putri Alif et al., 2022; Tavares et al., 2023).

So far, the existing literature on education and technology tends to look at it from three perspectives. First, technology brings a new face to the world of education and encourages educators to utilize technology in the learning process (Ambarwati et al., 2022; Chick et al., 2020; Mokalu et al., 2022; Scherer et al., 2019) And is seen as the key to the educational model of the future (Almarzooq et al., 2020; Faludi et al., 2023; Rohmah, 2023). Second, Technology-based learning media make it easier for teachers to present material (Firmadani, 2020; Isrokatun et al., 2023; Net, 2023) And improve the understanding of millennial learners of the material presented in the learning process (Ningsih et al., 2022; Nuryatin et al., 2023), Which can enable learners to learn faster, better, and smarter in disruptive situations (Hasanudin et al., 2022; Net, Puniatmaja, et al., 2023; Rohmah, 2023). Third, to achieve this idealism, innovation is needed in the learning process with well-designed technology as a tool to support knowledge development in learning. Learning and knowledge are designed according to the needs and psychological development of learners (Maulidah et al., 2023; Putri Supriadi et al., 2022; Taimur & Onuki, 2022; Zhao et al., 2021).

The argument used in compiling this study is that the world of education in the era of Society 5.0 requires digital technology-based education. This cannot be postponed because society is already living in a digital culture. The influence of technology continues to strengthen and humans are increasingly dependent on the use of technology, including the world of education. Society 5.0 has a digital character, referred to as a super-smart society because humans in this era have based all of their life activities on the use of technology (Wahyuningtyas et al., 2022). Next are students who come from the digital generation. The nature of the digital generation becomes an important reason for them to receive technology-based educational services because, theoretically, the digital generation can only develop optimally if they are connected to the internet, connected to the digital world as their real world (Fukuda, 2020; Khairunnisa Putri Alif et al., 2022). The last thing that needs attention is the threat of disruption that cannot be guaranteed not to happen. The experience of the Covid-19 pandemic has shown that technology-based education is education that is resilient to disruption. Thus, digital education, technology-based education, or integrating technology into education is an inevitability. The reason is that technology-based education is quality education, strong resilience, sustainable, futuristic, and compatible with the world of learners.

The existing literature is too focused on the benefits that technology provides to the world of education, the differences between traditional education and modern education that are integrated through technology, and teaching methods that make the material presented

very interesting, interactive, and expected to develop student's academic achievements. The research discussed previously has largely talked about the advantages and the urgency of digital education for students, but there is still a lack of research focusing on what steps can be taken by educational institutions to anticipate these issues. In this regard, this study aims to fill that gap in the literature.

This article aims to describe, explore, analyse, and convince stakeholders that a digital-based education transformation is necessary as a primary need in the context of a 5.0 society. In line with this, research questions have been formulated as guides in elaborating on the research topic, namely: a) What is the strategy to create education that is resilient to disruption, high quality, sustainable, and futuristic in the era of a 5.0 society? b) Why should technology be used in the education of the 5.0 society era? c) What are the implications for the world of education in the future if technology is not integrated into education?

## 2. METHODS

The use of technology in education has become an important issue since the global COVID-19 pandemic, the journey towards Society 5.0, and the nature of students as the digital generation. This needs to be given serious attention to gain a deep understanding of the phenomenon of educational practices in virtual spaces through the integration of digital technology. Recently, there have been numerous issues arising in technology-based educational services. Therefore, this topic has been intentionally selected as the research object for three reasons: 1) the increasing dominance of digital technology in human life, which cannot be avoided in everyday life, including education. Unfortunately, after the pandemic, technology-based educational services tend to be abandoned, and even online or distance education services have been discontinued.

However, these services have proven to have unique advantages that cannot be obtained in traditional education. 2) Limited attention has been given to analyzing the close relationship between technology and education. Existing literature has extensively studied the integration of technology into societal life. However, the analysis regarding the integration of technology and education as an urgent and essential need in the era of Society 5.0, in line with the nature of students and as a precaution against future disruptive threats, has been overlooked by scholars. 3) The foundational thinking on technology-based education within the framework of Society 5.0 is urgently needed to take preventive measures so that the education system can transform, adapt, and innovate in line with the needs and spirit of the times. Thus, education can genuinely and significantly contribute to the development of quality of life. These three reasons demonstrate that comprehensive understanding and analysis of education in the light of technology in Society 5.0 are significant as the policy foundation for developing the governance of modern educational systems.

This study on technology-based education is conducted using a descriptive qualitative research design. The aim is to explore knowledge and understanding of the significance of technology use in educational services. The primary focus is directed towards understanding the concepts of Society 5.0, the digital generation, and disruption. Through this, new knowledge will be gained on how advanced digital technology has become a driving force and its implications for the future of education. This study relies on secondary data obtained from literature studies and relevant online news articles related to the research topic. Primary data is only obtained through direct observations of educational practices and learning processes in schools after the pandemic. The literature used and analyzed consists of 40 sources focused on technology-based education in Society 5.0. These sources were retrieved from websites such as scopus.com and publish parish. In addition to journal articles, this

study also incorporates online news articles from Indonesian-based online news portals, specifically detik.com and detiknews.

The data is analyzed in three stages: data reduction, which involves organizing the data systematically; data presentation, which includes presenting the research findings in tabular form; and data verification, which involves drawing conclusions based on the observed data trends. The data processing techniques include descriptive analysis and content analysis. The process begins with data description as a foundation for contextual interpretation. Then, content analysis is conducted by the research objectives and research questions. The content analysis involves systematically examining and categorizing the data from the literature and online news articles to identify recurring themes, patterns, and key insights related to technology-based education in Society 5.0. This process helps in extracting meaningful information, identifying common trends, and drawing conclusions based on the analyzed content. The analysis includes coding and categorizing the data, identifying key ideas or concepts, and exploring relationships or connections between different sources and themes. Through this content analysis, a comprehensive understanding of the significance and implications of technology-based education in Society 5.0 can be gained. Stages of analysis and techniques used to formulate conclusions appropriately.

## 3. RESULTS AND DISCUSSION

### Results

This study highlights the education system and the practices of educational services that have taken place post-pandemic. The results of field observations in school environments indicate a decline in the transformation of technology-based education, to the point where it can be said that it is not being continued. Students are learning in face-to-face classroom settings every day, and online or distance learning has been discontinued. Digital learning is only utilized for specific subjects that involve seeking information related to the course material and watching YouTube videos using mobile phones and student data packages. The digital learning environment post-pandemic has not shown any progress, with no improvements or additions to the infrastructure for technology-based education. This is considered unnecessary because the COVID-19 pandemic is over, and students are attending physical classes every day. The following are some of the technology-based education models that are being developed and implemented in the current educational landscape. The result of technology-based educational models is show in Table 1.

**Table 1.** Technology-Based Educational Models

| Number | Learning Model | Definition | Source |
|---|---|---|---|
| 1 | Online Learning | utilizes multimedia technology virtual classes, CD / DVD ROM, video streaming, voice messages, email and conference calls, and video streaming | (Iga Setia Utami, Setia Budi, 2020) |
| 2 | Blended Learning | This learning model combines the use of technology with direct interaction between teachers and students. Typically, some of the content is delivered online through an online learning platform, while students also have face-to-face | (Lalima & Lata Dangwal, 2017) |

| Number | Learning Model | Definition | Source |
|---|---|---|---|
| | | sessions with the teacher for discussions, further explanations, or collaborative activities. | |
| 3 | Flipped Classroom | In this model, students learn the material independently through online learning resources before coming to class. When in the classroom, time is utilized for interactive activities such as discussions, collaborative projects, or consultations with the teacher. Technology is used as a means to access the material and support students' understanding before and during the classroom sessions. | (Upu & Akbar, 2022) |
| 4 | Game-based Learning | This approach utilizes computer games or game-based educational applications to teach and engage students in the learning process. The games are designed to facilitate conceptual understanding, enhance skills, and solve problems through engaging challenges and scenarios. | (Upu & Akbar, 2022) |
| 5 | Augmented Reality | It is the integration of digital information with live video about the user's environment in real-time. | (Palagiang & Sofiani, 2021) |
| | Virtual Realty | It is a technology that allows users to interact with a simulated virtual environment created by a computer, making them feel like they are inside that environment. In Indonesian, virtual reality is known as "realitas maya" or "realitas virtual." | (Palagiang & Sofiani, 2021) |
| 6 | Collaborative Online Learning | This model utilizes online learning platforms and collaborative tools to enable students to collaborate virtually. Students can work together on projects, engage in discussions, or complete assignments in a shared digital workspace. | (Haqqi, 2017) |
| 7 | Personalized Learning | This approach utilizes technology to provide personalized learning experiences tailored to the needs and pace of each student. Students can access materials, practice | (Putra et al., 2021) |

| Number | Learning Model | Definition | Source |
|---|---|---|---|
| | | activities, and receive customized feedback through adaptive learning applications or platforms. | |
| 8 | Mobile Learning | This model utilizes mobile devices such as smartphones or tablets to provide flexible learning access. Students can learn anytime and anywhere through mobile applications that provide learning content, exercises, and interaction with teachers or fellow students. | (Irawati et al., 2022) |
| 9 | Adaptive Learning | This model uses technology to collect data on students' learning progress and utilizes this information to develop individually tailored learning plans. Adaptive learning systems can identify students' strengths and weaknesses in a subject and then adjust the content and learning strategies to meet the needs of each student. | (Wahyu, 2021) |
| 10 | Online Discussion Forums | This model utilizes online discussion platforms to encourage interaction and collaboration among students. Students can participate in discussion forums managed by the teacher or even take on the role of a forum moderator. These online discussions allow students to share ideas, exchange opinions, and deepen their understanding of the topics being studied. | (Foong & McGrouther, 2010) |

## Discussion

Based on the explanation in the previous section, it can be formulated that the transformation of the education system towards digital education is driven by three factors. First, society 5.0, known as a super-intelligent society that emphasizes collaboration between humans and technology, such as AI, IoT, big data, and robotics, encourages inclusivity, resilience, and sustainability (Akhmadieva et al., 2023). The critical role of technology in education is evident and vital in Today's world. For example, the phenomenon of using GPT Chat in completing academic assignments by students and pupils. This tool has proven to play an important role and provide valuable benefits for the development of the educational sector. Academic tasks can be completed quickly and effectively with the help of artificial intelligence technology. Besides education, technology is also seen in using robotics to carry out routine and technical tasks in companies as service providers and customer welcomers (Pandarova et al., 2019). This fact teaches and gives a message that the world of education cannot be separated from the role of digital technology because education cannot be

implemented without looking at the concrete context of social life in society. In this case, education has a significant role in increasing students' knowledge, understanding, and skills in utilizing technology; at the same time, it is hoped that education will be able to strengthen and confirm the positioning of the importance of the human role, which cannot be replaced by technology.

Second, Today's students are a digital generation with the characteristics of technology being a part of their lives, multitasking abilities, access to broad information, high technology skills, and involvement in social media, interactive learning, and creativity in self-expression. The logical consequence is that educating them outside their world is an inappropriate action because, theoretically, the digital generation will only grow and develop optimally if they are connected to the digital world. The logical reason is that this generation was born and grew up amidst the rapid development of digital technology. Technological intrusion is getting stronger and cannot be avoided; it has changed human attitudes, patterns, and cultures. This itself automatically has an impact on the growth, formation of self-character, and self-potential of students. They will only feel 'alive' if they are connected to a gadget, or cell phone (Isni & Anugrah, 2021). They can last a long time and feel happy if they use digital activities. This is both an opportunity and a challenge for educators and education providers. The ability to take advantage of opportunities and respond to challenges appropriately and wisely will positively impact the personal development of individual students as well as the development of the world of education and the quality of social life in society in the future.

Third, an uncertain future will be free from the threat of global disruptions such as pandemics, climate change, natural disasters, and ecological disruption (Shi, 2018). All of this has consequences of severe efforts to anticipate the possibility of further disturbances (Tawafak et al., 2023). It is hoped that educational services will not stop and will be ready to face and adapt to the situation. Therefore, educational designs and models that are test-resistant and resistant to disruption are needed. To realize this, it is necessary to make concrete efforts to develop an education system that is adaptive, innovative, and responsive to the increasingly complex demands of society. The complexity of Today's life problems requires collaboration between various stakeholders: government, educational institutions, industry, and the general public to realize a serious, strong, quality, and successful digital education transformation.

Unfortunately, the digital education transformation process in Indonesia tends not to be responded to positively and seriously after the pandemic. This is demonstrated by returning the practice of the learning process to the classroom every day. The old paradigm still has a strong influence, namely, that teaching and learning activities must be carried out directly in the school and that students must meet with the teacher (De Leon, 2023; Hajisoteriou & Sorkos, 2023; Marieiev et al., 2023). Difficulties and obstacles that occur or are experienced when doing online learning during the pandemic (Ivanov et al., 2020; Octaberlina & Muslimin, 2020) have not been able to be interpreted as a moment, a valuable experience and a significant opportunity to improve the quality of education and develop a modern education model that is relevant to current developments through the transformation of education into a digital platform (Lee & Bailey, 2020; Qureshi et al., 2022; Susila et al., 2020). As previous literature has shown, online education is challenging because teachers' digital literacy is inadequate (Lemay et al., 2021; Putri et al., 2020; Sufian et al., 2020), insufficient digital learning environment (Camargo et al., 2020; Lapitan et al., 2021; Matli & Phurutsi, 2023; Nguyen et al., 2022), teachers lose authority in teaching (Gao & Zhang, 2020; Khairiah et al., 2022; Muassomah et al., 2022).

This reality is different from the international education landscape, where other countries have evaluated, explored, and improved post-pandemic technology-based education

services (Chomunorwa et al., 2023; R. Imran et al., 2023; Jogezai et al., 2023; O'Connor et al., 2023). The international world interprets the pandemic experience as a trigger for them to accelerate the transformation of digital education because the digital education model has provided, apart from being a new and exciting experience, has also had a positive impact on developing the quality of teaching and increasing student academic achievement. As shown in the previous section (results), previous literature has shown that integrating technology into educational services has been proven to positively impact quality, fun, durability, and the future. The author encourages and hopes that the health emergency experience can be understood and interpreted in depth to create awareness and belief that transforming education into digital education is an urgent matter that needs to be pursued immediately (Capone & Lepore, 2022; Ivanov et al., 2020; Valdés Hernández et al., 2023). Furthermore, the study encourages digital education not to be interpreted narrowly that technology-based education models are a last resort and are only required when a global pandemic such as COVID-19 occurs (Gan & Sun, 2022).

Implementing technology-based education will have implications for changes and improvements in educational services and learning processes. The following positive impacts can occur: a) enabling better, broader, and more accessible educational accessibility for students from various backgrounds. Technology can help overcome physical and geographic barriers that may hinder access to education, such as distance or infrastructure limitations. b) Personalized learning because technology allows a more personal and adaptive learning approach. By using digital tools such as computer-based learning programs or educational applications, students can learn at their own pace and learning style. This helps improve learning effectiveness and increases student motivation. c) Students' active involvement in the learning process increases. For example, students can participate in collaborative projects online, use interactive visualization tools, or create multimedia content to express their understanding.

This increases students' motivation and allows them to become active learners. d) Skills-based learning: Technology enables the integration of digital skills and 21st-century skills into the curriculum. Students can learn digital literacy, problem-solving, critical thinking, collaboration, and creativity skills through the use of technology. This helps prepare students to face the demands of an increasingly digital world of work (Alhashem & Alfailakawi, 2023). Thus, this description and analysis reflect the value and meaning that human abilities determine the quality of education in the future: teachers, students, and educational institutions in integrating technological sophistication into the national education system. Three crucial elements that encourage and influence education lead the government and stakeholders to implement new strategies to create a resilient, quality, sustainable, and futuristic education system in society 5.0, namely digital technology-based education. (Koesnandar, 2020; Mahmoud Saleh et al., 2023; Tóth et al., 2022).

This research contributes to providing new insights and paradigms in the organization of education in schools in the context of the digital era towards the development process of society 5.0. The transformation of digital education is a determinant of efforts to create a quality, resilient, and sustainable education system. Apart from the findings and analysis that have been presented, this research has limitations in methodological aspects because this qualitative research only uses secondary data through literature studies. Therefore, the findings of this study cannot be used to generalize the state and situation of educational transformation in the wider region of Indonesia. The findings of this study need to be complemented by conducting further studies in the future with qualitative and quantitative designs involving many respondents from both teachers and students. Thus, more complete information will be obtained that can be used to formulate policies to realize the appropriate and effective integration of technology into the education system in Indonesia.

## 4. CONCLUSION

The findings of this study reflect the meaning that the implementation of the education system is essentially in line with the context of the current social life reality of the community as well as futuristic. It isn't easy to imagine the practice of an education system that is not responsive to the concrete experiences of students in community life because educators and students do not live in a vacuum. This meaning implies that integrating technology into the education system is a precondition for education that suits the needs and spirit of the current digital era. In addition, this digital education design is a futuristic modern education model.

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