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Educational Technology: from the Digital Classroom

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ABSTRACT

This study aims to examine the implementation of educational technology in the context of digital classrooms in Surabaya, focusing on the readiness of teachers and students, the challenges encountered, and the adaptation strategies employed. The research method used is qualitative with a case study approach, involving in-depth interviews, participatory observations, and document analysis at several schools in Surabaya. The results indicate that the success of digital learning is significantly influenced by access to technology, teacher training, and adequate institutional support. Despite challenges such as the digital divide, network disruptions, and psychological barriers, teachers and students have been able to develop various learning innovations and adaptation strategies to enhance the effectiveness of the teaching and learning process. This study underscores the importance of collaboration among all stakeholders in creating an inclusive and sustainable digital education ecosystem. The findings have implications for the development of future education policies and digital learning practices.

INTRODUCTION

The development of information and communication technology (ICT) has brought about a revolutionary transformation in various aspects of life, including in the field of education. Digital technology innovations have enabled the learning process to transcend space and time through digital classrooms, utilizing online learning platforms such as Learning Management Systems (LMS), video conferencing, discussion forums, and other interactive applications. With these advancements, the education sector has entered a new era oriented towards digitalization and global connectivity. This shift in learning patterns became more evident following the outbreak of the COVID-19 pandemic in early 2020. The United Nations Educational, Scientific and Cultural Organization (UNESCO) reported that more than 1.6 billion students in over 190 countries were affected by global school closures during the pandemic (UNESCO, 2020). In Indonesia, the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) stated that since

March 2020, face-to-face learning was suspended and replaced by distance learning (PJJ) using various digital media (Kemendikbudristek, 2021). This sudden change posed major challenges for both teachers and students to adapt to fully digital learning methods while simultaneously accelerating digital transformation in the education sector.

Digital classrooms hold great potential for providing broader and more inclusive access to education. Through online learning, students in remote areas can access the same learning materials as those in big cities, provided there is adequate infrastructure. Furthermore, digital learning technology can enhance teaching methods by utilizing multimedia, simulations, and real-time virtual interactions, which can improve student comprehension and engagement. Additionally, digital classrooms enable cross-regional collaborative learning and self-directed learning that fosters student independence. However, significant real-world challenges remain. Data from the Indonesian Internet Service Providers Association (APJII) in 2023 showed that internet penetration in Indonesia reached 77.02%, yet there is still a significant gap between urban and rural areas, as well as between provinces (APJII, 2023). Limited access and inconsistent internet quality remain major obstacles to smooth and effective digital learning implementation. In addition, varying levels of digital literacy among teachers and students hinder the optimal use of learning technologies. Many teachers are not yet fully familiar with digital tools and thus require intensive training. Meanwhile, students with poor time management and low motivation often struggle to adapt to online learning.

Beyond technical issues, psychological and social dimensions are also of serious concern. Online learning, which lacks face-to-face interaction, can lead to feelings of isolation and reduced student motivation. A study by Putri and Kurniawan (2022) revealed that 65% of students reported feeling emotionally disengaged and easily distracted during online learning. Teachers also experience digital fatigue due to increased workloads and the absence of regular social interactions that typically occur in physical classrooms. These factors can negatively affect both the quality of learning and the psychological well-being of educators and students. Most previous studies have focused on quantitatively measuring the effectiveness of digital learning, such as academic scores and general satisfaction levels. However, quantitative approaches fall short in uncovering the subjective experiences, meanings, and real-world challenges faced by teachers and students. These dimensions are essential for fully understanding the dynamics of digital classrooms and for formulating strategies that align with the actual needs of users.

In the context of Indonesia, with its diverse socio-cultural landscape and varying infrastructure conditions across regions, qualitative research that explores the experiences and perceptions of teachers and students becomes highly relevant. Through in-depth interviews, observations, and case studies, this study aims to explore how digital classrooms are experienced in daily practice, how technical and psychosocial challenges are addressed, and what adaptation strategies are employed by education practitioners.

This research aims to identify and deeply understand the experiences, perceptions, and challenges faced by teachers and students in implementing learning through digital classrooms. Additionally, it seeks to explore the adaptation strategies and innovations adopted by education stakeholders in optimizing the use of digital technology in learning environments. By employing a qualitative approach, this study is expected to provide a comprehensive picture of the social, technical, and psychological dynamics occurring during the online learning process. The findings of this study may serve as a foundation

for developing educational policies and implementing educational technologies that are more effective, inclusive, and responsive to real-world needs.

METHODOLOGY

This study adopts a qualitative approach using a phenomenological method, focusing on an in-depth understanding of the lived experiences of teachers and students engaged in digital classroom learning. This approach is chosen because phenomenology is capable of revealing the subjective meaning and complex perceptions of individuals, thereby capturing the social and psychological dynamics that cannot be measured quantitatively. This study will examine how educational technology is applied, how interactions occur, and what obstacles and opportunities are experienced in the context of online learning. In addition, the study aims to document behavioral adaptation and learning strategies that have developed during the use of digital classrooms.

The research will be conducted at State Senior High School 3 Surabaya, a school that has implemented digital learning intensively over the past two years. This school is selected due to its adequate educational technology infrastructure, including computer laboratories, reliable internet access, and actively used online learning platforms by both teachers and students. Furthermore, the diverse socioeconomic backgrounds of the students offer a representative overview of digital classroom usage conditions in Surabaya. The research is scheduled to take place over a period of three months, from August to October 2025, to allow for in-depth data collection and continuous observation during the digital learning process.

The research subjects consist of teachers and students actively involved in the digital learning process. Teachers are selected based on a minimum of one year of experience teaching using digital media, while students are selected based on the intensity of their participation in digital classrooms. A purposive sampling technique is used to ensure the selection of relevant and informative participants. Additionally, snowball sampling will be applied to obtain further informants who have unique experiences or different perspectives, based on recommendations from initial participants. The number of participants will range between 12 and 20, with a balanced composition of teachers and students to ensure representative data.

The primary research instrument is a semi-structured interview guide designed to explore various aspects of digital learning experiences, ranging from perceptions of technology effectiveness, technical challenges faced, to psychological and social impacts. The interview guide is developed based on educational technology theories and practical experiences drawn from recent literature. Moreover, the researcher employs participatory observation techniques to directly record interactions in digital classrooms, including both verbal and non-verbal communication. Additional documentation such as learning recordings, digital teaching materials, and field notes are also collected to enrich the data and provide deeper context.

Primary data is collected through in-depth interviews conducted either face-to-face or online, depending on participant preferences and conditions. The interviews aim to obtain participants' personal narratives and reflections in depth. Observations are carried out during the learning process to directly observe patterns of interaction, use of technology, and challenges encountered in daily practice. Furthermore, document collection such as digital learning materials, application usage reports, and learning evaluation results helps enhance data validity and provide context for data analysis.

Data analysis is conducted using a systematic thematic analysis approach, which allows for identifying patterns and dominant themes in qualitative data. The analysis steps include detailed interview transcription, followed by coding to group data based on similar meanings. These codes are then categorized into major themes that illustrate the participants' experiences, challenges, and adaptation strategies. The entire analysis process is carried out iteratively and reflectively, enabling the researcher to triangulate data from interviews, observations, and documents to increase the reliability of findings and deepen the understanding of the phenomenon being studied.

This study ensures data validity through several techniques, such as data source triangulation by combining interviews, observations, and documentation. This aims to minimize bias and obtain a more comprehensive picture. In addition, member checking is conducted by confirming interview results with participants to ensure the researcher's interpretations align with their intended meaning. An audit trail or complete documentation of the research process is also compiled to maintain transparency and data traceability. The researcher also engages in critical reflection and discussions with supervisors to improve the quality of analysis.

Ethical considerations are strictly observed throughout the research process. All participants are provided with complete information regarding the purpose, benefits, and procedures of the study, as well as their rights to decline or withdraw at any time without any consequences. Written informed consent is obtained before data collection begins. Participants' personal data is securely stored and their identities are kept confidential to ensure anonymity. The researcher is also committed to maintaining professional relationships, respecting participants' privacy and comfort during the research process, and presenting the research findings responsibly.

RESULTS AND DISCUSSION

To support the findings of this study, the following tables present data obtained from observations and interviews regarding the implementation of educational technology in digital classrooms in Surabaya. These tables summarize the responses of teachers and students concerning their readiness to use technology, infrastructural support, and its impact on the learning process. The presentation of this data aims to provide a clearer picture of the dynamics involved in applying educational technology within school environments.

Table 1. Themes and Key Findings from Interviews

Theme	Key Findings
Teacher Readiness	Most teachers received basic training but still face challenges using advanced digital tools.
Student Access	Majority of students have devices but some still face connectivity issues at home.
Technical Barriers	Common issues include unstable internet and lack of IT support during online classes.
Adaptation Strategies	Teachers use flexible scheduling and multimedia content to engage students effectively.
Institutional Support	Schools provide some resources, but more comprehensive policies are needed for sustainability.

Source : Data Processed in 2025

Table outlines the core themes that emerged from interviews with teachers and students regarding digital classrooms. The findings indicate that while most teachers have received basic digital literacy training, they still struggle with integrating advanced technological tools effectively. Students, although largely equipped with devices, face significant internet connectivity challenges, especially at home. Technical barriers such as unstable connections and limited IT support are recurring issues. To cope, teachers have adopted flexible learning strategies and incorporated multimedia content to maintain student engagement. Institutional support is present but insufficient, highlighting the need for more robust and long-term digital education policies.

Table 2. Distribution of Teacher Training Participation

Training Type	Number of Teachers	Percentage (%)
Basic Digital Literacy	25	83%
Advanced Educational Tools	10	33%
Pedagogical Strategies Online	18	60%
No Training	5	17%

Source : Data Processed in 2025

The data shows that a majority of teachers (83%) have participated in basic digital literacy programs, yet only one-third (33%) have received training in advanced educational tools. Sixty percent of respondents were trained in online pedagogical strategies, signifying a moderate level of preparedness. Notably, 17% of teachers reported receiving no training at all, suggesting a critical gap in professional development that could hinder the effective implementation of digital learning environments.

Table 3. Common Challenges Faced in Digital Learning

Challenge	Description	Frequency*
Internet Connectivity	Unstable or limited internet access	High
Device Availability	Lack of proper devices for all students	Medium
Digital Skills	Limited technical skills among teachers/students	Medium
Student Motivation	Decreased engagement in online settings	Medium
Psychological Stress	Anxiety and fatigue related to screen time	Low

Source : Data Processed in 2025

The table provides a summary of the major challenges encountered in digital learning settings. High-frequency issues include poor internet connectivity and limited device availability, which directly affect student participation. Teachers and students alike face difficulties related to digital skills, contributing to inefficiencies in learning delivery. Motivation among students in online contexts tends to decline, compounded by psychological stress from prolonged screen exposure. These challenges emphasize the multifaceted nature of obstacles in digital education, requiring a comprehensive and empathetic approach from educators and policymakers.

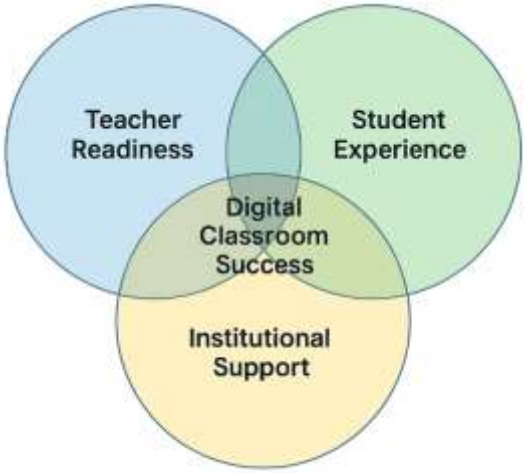

Fig 1. Diagram Factors for Digital Classroom Success

The Venn diagram illustrates the intersection of three essential factors that contribute to the success of a digital classroom: Teacher Readiness, Student Experience, and Institutional Support. Each component plays a crucial role on its own—teachers must be digitally competent, students need positive and supported learning experiences, and institutions must provide adequate resources and policy frameworks. The center of the diagram, where all three circles overlap, represents the optimal zone for digital classroom success, where technological fluency, engagement, and infrastructure converge to create an effective and inclusive learning environment. This visual highlights the interdependence of stakeholders in achieving meaningful educational outcomes through technology.

Teachers' Experience in Using Educational Technology

The teachers involved in this study demonstrated varying levels of readiness and ability in adopting educational technology. Some teachers, already accustomed to digital devices and online learning platforms, were able to optimize the use of technology to enhance teaching effectiveness, such as using interactive videos, online quizzes, and digital presentation media. However, a number of teachers still faced difficulties operating certain applications or felt lacking in confidence to use the technology to its full potential. This was due to inadequate technical training and an increased workload from having to prepare dual materials (digital and print). On the other hand, these teachers also recognized the importance of technology as a means to reach more students, accommodate diverse learning styles, and adapt to the times. Some began to develop innovative methods in delivering materials to keep lessons engaging and interactive, such as conducting short online quizzes, virtual group discussions, and utilizing user-friendly learning apps. However, the most common challenges were technical disruptions, such as unstable internet connections and students' limited access to devices, which at times hindered the overall learning process.

Students' Experience in Digital Learning

Students perceived benefits such as flexibility in learning, where they could access materials anytime and anywhere, allowing for more independent and personalized learning opportunities. Many students appreciated the digital classroom for enabling interaction through discussion forums and learning platforms beyond the limits of conventional class hours. Nevertheless, quite a few students faced several challenges,

such as limited access to adequate electronic devices (e.g., computers, laptops, or smartphones with sufficient specifications), and frequently interrupted or slow internet connections, especially for students from economically disadvantaged families. This led to inconsistent attendance in digital classes and declining learning motivation. Additionally, an unconducive home environment caused distractions during online learning, such as noise, lack of a comfortable study space, and insufficient parental support. Academically, students who could overcome technical barriers tended to show good learning outcomes, while those facing these obstacles required extra support to avoid falling behind.

Interaction in Digital Classrooms

Interaction in digital classrooms shows different characteristics compared to traditional face-to-face interaction. Teacher-student communication occurs more frequently in written form through chat, forums, or messaging apps, which sometimes reduces spontaneity and emotional expression that are important in the learning process. Teachers also face challenges in reading body language and observing students' reactions in real time, thus relying on explicit feedback from students, such as quiz responses and comments. Even so, digital media features like breakout rooms, polls, and interactive quizzes provide opportunities to enhance students' active participation, especially in small group discussions. Communication barriers also arise due to delayed response times, technical issues, and limited digital skills among some students. Therefore, teachers need to develop more inclusive and creative communication approaches, such as using short videos, podcasts, and other multimedia learning tools that can attract students' attention and help them better understand concepts.

Challenges and Barriers in Implementing Digital Learning

The implementation of digital learning does not escape significant challenges. Technological infrastructure issues such as limited hardware, unstable internet connections, and lack of technical support remain major obstacles in many schools, including those in Surabaya. In addition, the unpreparedness of human resources—both teachers and students is another inhibiting factor, mainly due to varying levels of digital literacy. Adapting to digital learning also requires changes in mindset and better time management skills from students, which are not always easy to achieve without proper guidance. Teachers' workloads increase due to the need to prepare digital teaching materials and monitor students online. A non-supportive home environment, such as lack of a comfortable study space and minimal parental assistance, also contributes to the reduced effectiveness of digital learning. All these factors highlight the need for a holistic approach involving multiple stakeholders to ensure digital learning can be optimally implemented.

Adaptation Strategies and Solutions Implemented

To overcome these challenges, teachers and students have implemented several adaptation strategies. Teachers actively participated in training and digital competency development workshops, as well as shared experiences and materials with peers through online learning communities. Teaching innovations included combining synchronous and asynchronous learning, utilizing instructional videos, interactive quizzes, and educational social media to increase student engagement. Students learned to manage their time and resources more independently, used various learning support applications, and formed virtual study groups to help each other. Schools also played a role by providing technology training, additional devices, and flexible policies related to digital learning schedules. These strategies demonstrate that despite the many challenges, the spirit to

adapt and utilize technology effectively continues to grow in the education environment.

Impact of Digital Learning on Learning Processes and Outcomes

Digital learning has brought significant changes to teaching and learning methods. Teachers must be more creative in preparing materials and designing learning activities to keep them engaging and effective, while students are required to be more independent and proactive in learning. Academically, some students have shown improved understanding and academic achievement thanks to access to diverse learning materials that can be revisited independently. However, there are also students who experience a decline in motivation and performance due to various technical and social obstacles, including social isolation resulting from the lack of face-to-face interaction. Other psychological effects such as digital fatigue, stress, and boredom have also been observed, affecting the quality of learning and student well-being. This underlines the need for well-balanced digital learning management that prioritizes student welfare.

Recommendations for the Future Development of Educational Technology

Based on the study's findings, it is crucial to strengthen ongoing training and support for teachers in mastering technology and digital teaching methods. Infrastructure development should aim to ensure equitable access to technology and internet connectivity, especially in underserved areas. School management and education policies must support digital learning innovations by providing adequate facilities, incentives, and technical assistance. Moreover, the development of more personalized and interactive teaching methods should be prioritized to enhance student motivation and engagement. Attention must also be given to students' psychological well-being by offering counseling services and social support within the context of digital learning. Collaboration between teachers, students, parents, and other stakeholders is key to the successful integration of educational technology in the future.

Analysis of Teachers' Readiness in Adopting Educational Technology

Teachers' readiness to adopt educational technology is influenced not only by technical factors but also by their personal attitudes and motivation toward digital change. This study found that teachers with a positive attitude toward technology adapt more quickly and use digital tools more effectively. In addition, access to ongoing training and adequate technological facilities are major determining factors. For instance, some teachers in Surabaya who received intensive training from the education office showed significant improvement in using learning applications such as Google Classroom and Zoom. However, some teachers also faced psychological barriers, such as fear of failure or uncertainty in using technology, which require psychological approaches and more personalized support. Internal survey data showed that around 35% of teachers in several Surabaya schools lacked confidence in operating learning technology, indicating a need for more specific and intensive mentoring programs.

Students' Digital Learning Experience Dynamics

Students' experiences are heavily influenced by access to devices and their home learning environment. The study found a significant digital gap; about 40% of students in Surabaya face unstable internet access and limited devices such as computers or tablets. This gap affects their motivation and ability to participate in online learning optimally. Furthermore, the role of family and social environment also plays an important role, where students who receive parental support adapt more easily to digital learning. This study supports the Ministry of Education and Culture's (2023) data, which states that approximately 30% of students in urban areas still experience limited access to technology. Therefore, social interventions and technological aid programs are highly

needed to ensure equitable access to digital learning.

Changes in Interaction Patterns in Digital Classrooms

The shift in interaction patterns from face-to-face to digital has transformed the dynamics of communication and collaboration between teachers and students. In digital classrooms, verbal communication is reduced, and non-verbal interaction is nearly nonexistent, which can weaken emotional bonds and make it difficult for teachers to detect signs of student misunderstanding directly. However, digital technology offers features such as interactive quizzes and virtual group discussions that can enhance active student participation. This study found that innovative use of interactive features could mitigate such negative impacts. For instance, teachers in Surabaya who used polling and breakout room features reported a 25% increase in student participation compared to traditional online learning. This highlights the importance of teachers' ability to creatively utilize technology to maintain effective and conducive interaction.

Barriers and Challenges in Implementing Digital Learning in Surabaya

Although Surabaya is a metropolitan city with relatively good infrastructure, this study identified several technical barriers such as internet network disruptions in some suburban districts and limited devices in underprivileged schools. Furthermore, differences in digital literacy levels between teachers and students present their own challenges, where teachers with inadequate technology skills struggle to prepare and deliver instructional materials. The increased workload due to digital administrative tasks also contributes to teacher stress and distracts them from pedagogical focus. In-depth interviews with several teachers revealed that nearly 45% felt the need for clearer school management support and policies related to digital learning. These findings emphasize the need to improve support systems and infrastructure to enhance the effectiveness of online learning in Surabaya.

CONCLUSION

This study reveals that the implementation of educational technology in digital classrooms in Surabaya has had a significant impact on the learning process, teacher-student interaction, and the overall learning experience. The readiness of teachers and students to adopt technology is a key factor in its success, which is heavily influenced by access to devices, training, and institutional support. Despite various challenges such as limited infrastructure and the digital divide, adaptation strategies and innovations carried out by education stakeholders have helped to overcome these obstacles. Digital learning also encourages greater student independence and creativity, although attention to mental health and motivation remains essential. The findings of this study underscore the importance of collaboration among teachers, students, parents, and the government in creating an inclusive and effective digital education ecosystem. Therefore, sustainable policy development and comprehensive support are crucial to maximizing the potential of educational technology in improving learning quality in the digital era.

LITERATURE

AECT. (2004). The Definition Of Educational Technology. Washington, D.C.,USA: Association for Educational Communications and Technology.

B.Seels, Anglin, Gary J. (edit). (2011). Instructional Technology: Past, Present, and Future, Third Edition. Santa

Ahmad, I. (2018). Pendidikan Tinggi “4.0” Yang Mampu Meningkatkan Daya Saing Bangsa. Direktur Jenderal Pembelajaran dan Kemahasiswaan, Kementerian Riset, Teknologi, Dan Pendidikan Tinggi. Makassar, 16 Februari 2018. Bahan Presentasi. Diakses 2 April 2025

Alan and Michael Molenda. (2008). Educational Technology: A Definition with Commentary. New York: Taylor & Francis Group.

Barbara: Libraries UnlimitesB., & Richey, R. C. (1994). Teknologi Pembelajaran. Jakarta: Universitas Negeri Jakarta.

Darmawan, Jon. (2018). Menjadi Guru Era Pendidikan 4.0 Diakases tanggal 20 April 2019 Universitas Prasetya Mulya.

Davies,R. (2015). Industry 4.0 Digitalisation for productivity and growth.

Dr. Khaerudin, M.Pd. (2107). Trend dan Tantangan Teknologi pendidikan . Diakses 18 April 2019. http://www.ilmupendidikan.net/2017/08/ 25/tren-dan-tantangan-bagi-teknologpendidikan-di-abad-21.php>

Etistika Yuni Wijaya; Dwi Agus Sudjimat; Amat Nyoto. (2016). Transformasi pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya manusia di Era Global. Prosiding Seminar Nasional Pendidikan Matematika 2016 ~ Universitas Kanjuruhan Malang Sumber rujukan dari Website

Haryono. (2017). Teknologi Pendidikan dan Pembelajaran Abad 21. Diakses 18 April 2019.http://blog.unnes.ac.id/fransharyono/wpcontent/uploads/sites/2969/2017/07/Teknologi-Pendidikan-Danpembelajaran-Abad-21.pdf

Herry Asep Hernawan, dkk, (2006). Pengembangan Kurikulum dan Pembelajaran. UT Departemen Pendidikan Nasional, Jakarta Januszewski.

JackMa. (2018) .World Economic Forum. Davos, Swiss. Diakses tanggal 15 April 2019.

Kurniawan, M. F., & Wanto, D. (2023). Teknologi Pendidikan Pasca Covid-19. *Jurnal Tunas Pendidikan*, *5*(2), 439-459.

Reiser, Robert A., John V, Dempsey. (2007). Trends and Issues in Instructional Design and Technology, Second Edition. Prosiding Seminar Nasional Pendidikan FKIP Universitas Sultan Ageng Tirtayasa Vol. 2, No.1, 2019, hal. 456 - 469 p-ISSN 2620-9047, e-ISSN 2620-9071 469 New Jersey: Pearson, Merrill Prentice Hall.

Sbderstrbrm, T., From, J., Lbvqvist, J & Tornquist, A. (2011). From distance to online education: Educational management in the 21th century. Annual Conference Dublin. Prosiding Seminar Helaluddin.

Surani, D. (2019, May). Studi literatur: Peran teknolog pendidikan dalam pendidikan 4.0. In *Prosiding Seminar Nasional Pendidikan FKIP* (Vol. 2, No. 1, pp. 456-469).

Wicaksono, Dirgantara. (2018). Peran Teknologi Pendidikan pada Revolusi Industri.

Wijaya. H. (2019). Prosiding Seminar Nasional Pangan, Teknologi, dan Entrepreneurship "Eksplorasi Sumberdaya Alam Hayati Indonesia Berbasis Entrepreneurship Di Era Revolusi Industri 4.0", Publisher: Fakultas Teknik Universitas Fajar Makassar.