Technology-Based Learning Strategies to Improve the Quality of Human Resources in National Development

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ABSTRACT

Technology-based learning has become one of the main solutions in improving the quality of education in the digital era. In Indonesia, the application of technology in education faces major challenges, especially in rural areas, such as limited infrastructure and lecturer training. The purpose of this study is to analyze how technology-based learning strategies can improve the quality of Human Resources (HR) in the context of national development, with a focus on education in rural areas. The research method used is a qualitative approach with a case study design, which involves interviews, observations, and questionnaires to lecturers, students, and managers of educational institutions. The results show that although technology expands access to learning materials, the main challenges faced are the lack of lecturer training and the limitations of internet devices and infrastructure, especially in rural areas. Technology-based learning can improve the quality of human resources by providing flexibility in learning, but its impact on the development of students' digital skills is highly dependent on the existing infrastructure. This research suggests the need for increased training for teachers and the development of technological infrastructure as part of sustainable village development efforts.

Keywords: technology-based learning, quality of human resources, village development, educational infrastructure, lecturer training.

INTRODUCTION

In the current era of globalization, the development of information and communication technology (ICT) has changed many aspects of human life, including the education sector (Bógdał-Brzezińska, 2020; Cholik, 2021). Digital technology has not only changed the way we communicate and work, but also the way we learn and develop ourselves. This phenomenon provides challenges as well as opportunities in improving the quality of human resources (HR) in various

countries. Globalization accelerates the flow of information and demands the improvement of human resource competencies to compete in an increasingly competitive global market (Bangsawan, 2023; N. P. Sari et al., 2023). Countries that want to maintain their competitiveness on the international stage must utilize technology in the learning system to produce more qualified human resources.

In Indonesia, despite significant developments in the use of technology in the field of education, the quality of human resources is still a major challenge in achieving sustainable national development (Fatimah et al., 2020; Supratikta et al., 2024). A report by the Central Statistics Agency (BPS) shows that there is still a lot of inequality in the quality of education between urban and rural areas, as well as a lack of technical skills relevant to the needs of the job market. In addition, more conventional learning systems and limited to face-to-face methods are not able to keep up with the needs of more flexible and technology-based learning. This is the main problem in preparing human resources who are adaptive to rapid changes in the digital era.

Some previous research has shown that technology can play an important role in improving the quality of human resources. For example, research conducted by Sari et al., (2021) found that the use of technology in learning can improve student motivation and learning outcomes. Another study by N. P. Sari et al., (2023) shows that the application of online learning systems can improve students' technical skills and cognitive abilities. However, these studies have not emphasized the importance of integrating technology-based learning strategies in the context of overall national human resource development. Therefore, this study seeks to fill this gap by investigating how technology-based learning strategies can improve the quality of human resources in the context of national development.

The urgency of this research is very high considering the major challenges faced by Indonesia in developing competitive human resources at the global level. Successful national development depends on the country's ability to produce a skilled, knowledgeable, and adaptable workforce to technological changes. Therefore, it is important to understand how technology-based learning can be effectively applied to improve the quality of human resources, so as to support sustainable and inclusive national development goals.

This research offers a new approach by focusing on the integration of technology-based learning in order to improve the quality of human resources nationally. Unlike previous research that only focused on the implementation of technology at the level of educational institutions or on certain technical aspects, this study examines the impact of the use of technology in a broader context, namely to build human resources who are ready to face national development challenges. This research also highlights how government policies and education systems can support the adoption of technology in learning to improve the quality of human resources.

Existing research tends to focus more on technology adoption in isolated educational settings or technical skills development without addressing the broader implications for human resource development at the national level, especially in rural areas. In addition, challenges related to infrastructure, limited equipment, and inadequate lecturer training have not been fully examined in relation to how these factors specifically hinder human resource development in rural areas, where

technology adoption is still uneven. This research fills this gap by exploring how effective technology-based learning strategies can contribute to national human resource development, particularly in rural areas, and how these strategies can bridge the gap between technology access and educational outcomes.

The main objective of this study is to identify effective technology-based learning strategies in improving the quality of human resources in Indonesia. This research also aims to analyze how the implementation of technology in learning can improve technical skills, conceptual understanding, and students' adaptability to changes in the world of work. Thus, this research is expected to contribute to the development of educational strategies that are more relevant to the needs of the times.

The benefit of this research is that it provides new insights for policymakers in formulating more technology-based learning strategies. This research can also provide guidelines for educational institutions in designing curricula and teaching methods that are more relevant to the needs of industry and technological developments. In addition, the results of this study can enrich the literature on the role of technology in improving the quality of human resources and contributing to the improvement of the national education system.

The implication of this study is to provide recommendations for stakeholders, including governments, educational institutions, and the private sector, to implement technology-based learning strategies that can improve the quality of human resources. This is important so that Indonesian human resources are not only technically skilled but also have the ability to innovate and compete at the global level. This research also implies the importance of collaboration between the education sector and industry in designing training programs that are relevant to market needs. The findings of this study contribute to a scientific understanding of how technology-based learning strategies can improve the quality of human resources, especially in rural areas. By identifying the challenges faced in educational institutions, such as limited infrastructure and lack of training for lecturers, the study provides insight into how these barriers can be overcome.

METHODS
Types of Research
This research uses a qualitative approach with the aim of understanding and delving deeper into the application of technology-based learning strategies to improve the quality of human resources (HR) in the context of national development (Abubakar et al., 2024; Sugiyono, 2017). The qualitative approach was chosen because this research aims to explore the views, experiences, and practices carried out by various parties involved in the application of technology in the education sector. Qualitative research allows researchers to explore the meaning behind observed phenomena, identify challenges, and explore stakeholder perceptions related to technology-based learning strategies.

Research Design
The research design used is a case study, where the researcher will focus on collecting data related to the application of technology in learning in several educational institutions in Indonesia. This case study aims to analyze in depth how various factors affect the effectiveness of the use of technology in improving the

quality of human resources. This research will also use an analytical descriptive approach to analyze the data obtained and provide a clearer picture of the phenomenon being studied. The researcher will identify various aspects that support and hinder the implementation of technology-based learning strategies and examine their impact on the quality of human resources.

Location and Research Subject

This research was conducted in several selected educational institutions in Indonesia, both in urban and rural areas, with the aim of obtaining a representative picture of the application of technology in education. The research location was selected based on the criteria of diversity of available technological infrastructure as well as differences in technology adoption in the educational environment. The research subjects include various parties involved in the educational process, such as lecturers/teachers, students/students, and managers of educational institutions. The researcher will choose a research subject based on the purposive sampling technique, where the chosen subject has knowledge and experience that is relevant to the research topic, namely the use of technology in learning.

Research Instruments

The main instruments in this study were semi-structured interviews and observations. Semi-structured interviews are used to explore the perspectives of various parties involved in the use of technology in learning, such as lecturers/teachers, students/students, and managers of educational institutions. This interview allows researchers to get in-depth information about their understanding, experiences, and challenges faced in the application of educational technology. In addition, observation is used to directly observe the implementation of technology-based learning strategies in the classroom, in order to obtain more objective and in-depth data on the application of technology in the context of education.

Data Collection Techniques

The data collection technique in this study consists of several stages, namely:

1. **Semi-Structured Interviews**

This interview was conducted by selecting key informants from the research subjects. Interview questions are structured based on research objectives, and will be directed to explore experiences, perceptions, and challenges faced in the application of technology in education. These interviews will be conducted face-to-face or through online platforms, depending on the situation and location of the informant.

2. **Participatory Observation**

The researcher will make direct observations on the use of technology in classroom learning. In this observation, the researcher will record various aspects related to the learning strategies applied, such as the interaction between teachers and students, the use of technology devices in learning, and the response of students to the applied technology. These observations will also be used to assess the extent to which technology can facilitate an effective learning process.

3. **Documentation**

The researcher will also collect secondary data through relevant documents, such as education policies, reports on the use of technology in educational institutions, and technology-based learning materials. This documentation is used

to complement the data obtained from interviews and observations, as well as provide a more complete context regarding the implementation of technology in learning.

Data Analysis

After the data is collected, the data analysis will be carried out with a thematic analysis approach, where interview and observation data will be grouped based on the main themes that emerge from the data. This analysis aims to identify patterns, challenges, and factors that affect the implementation of technology-based learning strategies. The researcher will triangulate the data by comparing the results of interviews, observations, and documentation to increase the validity and credibility of the findings.

RESULTS AND DISCUSSION

General Description of Respondents

This study involved 50 respondents consisting of 20 lecturers and 30 students in three educational institutions in Indonesia who have implemented technology-based learning. Respondents were selected using purposive sampling techniques, with selection criteria based on direct involvement in the technology-based learning process. The demographic details of the respondents can be seen in Table 1 below:

Table 1. Respondent Demographics

Category	Number of Respondents	Percentage (%)
Lecturer	20	40%
Student	30	60%
Man	18	36%
Woman	32	64%
Ages 18-25	25	50%
Age 26-35 years old	15	30%
Age 36-45 years old	10	20%

Most of the respondents were students with an age range of 18-25 years, while lecturers were more evenly distributed in the older age range. Most of the respondents have experience using technology in learning, either directly or through digital educational devices.

Research Results

The Application of Technology in Learning: An Evaluation of the Effectiveness of Use

The application of technology in learning in Indonesia shows various levels of success in each institution. Based on the results of interviews with the management of educational institutions, most institutions have adopted e-learning and online learning platforms as part of their main strategy. The platform allows students to access materials flexibly, reducing the physical limitations of the classroom. In addition, the use of applications such as Zoom and Google Classroom greatly supports interaction between lecturers and students.

However, the results of observations show that the effectiveness of the use of technology in learning is still influenced by the available infrastructure. Some institutions face problems related to unstable internet connections, especially in remote areas. The use of technology, while improving the accessibility of materials,

can sometimes not be optimized due to technical barriers. The graph below illustrates students' perceptions of the positive impacts and challenges of technology in learning.
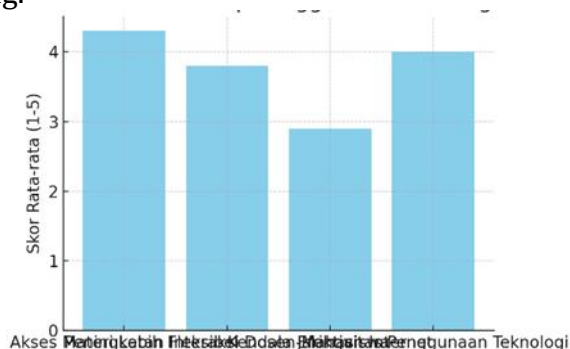
Graph 1. Students' Perceptions of the Use of Technology in Learning

**Table 2. The Influence of Technology on Access to Learning Materials**

Aspects Evaluated	Average Score (1-5)	Percentage of Students Who Agree (%)
More flexible access to materials	4.3	75%
Increased lecturer-student interaction	3.8	65%
Internet network constraints	2.9	50%
Effectiveness of technology use	4.0	72%

Based on the table above, it can be seen that most students agree that technology improves the accessibility of learning materials, but internet network constraints are still a significant problem that affects the success of technology-based learning. Nonetheless, the majority of respondents felt that technology helped smooth the learning process despite some technical challenges faced.

Challenges in the Implementation of Technology-Based Learning

The challenges faced in the implementation of technology-based learning are quite diverse. Based on the findings of interviews with education managers, the lack of adequate training for lecturers is one of the main obstacles. Many lecturers still find it difficult to utilize various digital learning platforms optimally. Although most lecturers have received training, their level of skill in using technology interactively and innovatively is still limited.

In addition, the results of the questionnaire given to licensed employees showed that the number of inadequate devices in some educational institutions also worsened the effectiveness of learning. The limitations of devices such as computers or tablets make the learning process not run as smoothly as expected. The following graph illustrates the challenges most often faced by respondents in the application of technology in learning.
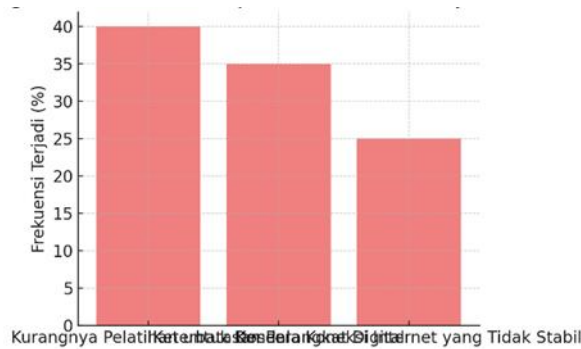
Graph 2. Key Challenges in the Implementation of Technology-Based Learning

**Table 3. Challenges Faced in the Implementation of Technology in Education**

Challenges Faced	Frequency of Occurrence (%)
Lack of training for lecturers	40%
Limitations of digital devices	35%
Unstable internet connection problems	25%

This table illustrates that most respondents identified a lack of training as the biggest challenge in the implementation of technology-based learning. Most institutional managers also highlight the problem of device limitations as an inhibiting factor that can affect the quality of the learning process.

The Influence of Technology-Based Learning on the Quality of Human Resources

The main goal of implementing technology-based learning is to improve the quality of human resources (HR). Based on the results of interviews with students and lecturers, most respondents felt that technology helped improve their skills in managing information and adapting to new technologies. Students, in particular, find it more helpful in terms of flexibility in terms of study time and access to a wide range of learning resources that they previously couldn't reach.

However, the biggest challenge is the lack of active engagement in online learning sessions. Based on observations, some students show inactivity in online classes, which can reduce the effectiveness of the learning process. The following graph illustrates the impact of technology on student engagement in learning.
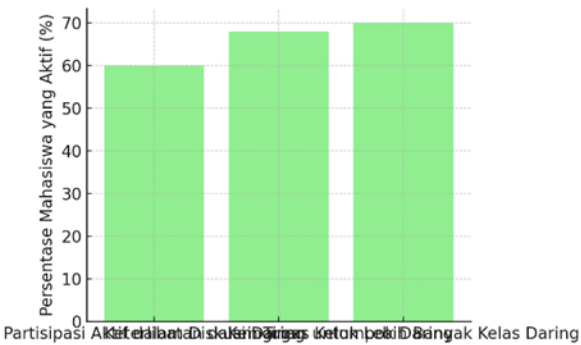
Graph 3. The Influence of Technology-Based Learning on Student Engagement

Table 4. The Influence of Technology on Student Engagement in Learning

Aspects of Engagement	Average Score (1-5)	Percentage of Active Students (%)
Active participation in online discussions	3.5	60%
Involvement in online group assignments	3.9	68%
The desire for more online classes	4.1	70%

Based on the table, although the majority of students consider technology to provide flexibility and convenience, active participation in online group discussions and assignments tends to be lower. This shows that while technology facilitates learning, students' direct involvement in online learning is still an area that needs improvement.

Recommendations for Improving the Implementation of Technology-Based Learning

Based on the findings obtained from interviews, observations, and questionnaires, several recommendations can be given to improve the application of technology-based learning. First, educational institutions must pay attention to the need for continuous training for lecturers to master various digital platforms and design more interactive learning. This training should include how to use more innovative and engaging educational apps to increase student engagement.

Second, strengthening technology infrastructure must be a priority, especially in areas that are underserved by stable internet access. The provision of adequate devices and increased connectivity will greatly support the successful implementation of technology-based learning.
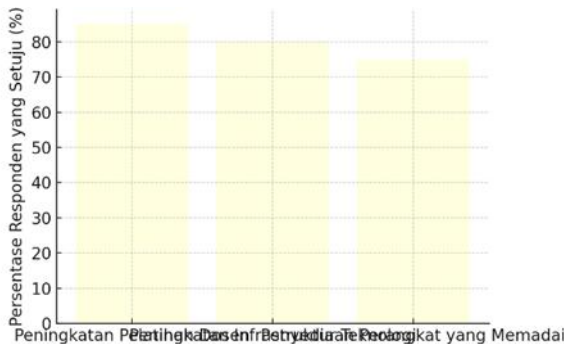
Graph 4. Recommendations for Improving Technology-Based Learning

Table 5. Recommendations for Improving Technology-Based Learning

Recommendations	Percentage of Respondents Who Agree (%)
Improved lecturer training	85%
Improvement of technological infrastructure	80%
Adequate provision of devices	75%

This table shows that the majority of respondents agree with the importance of improving training for lecturers and providing better technology infrastructure to support technology-based learning.

Discussion of Research Results
The Effectiveness of Technology-Based Learning in Improving Education

The integration of technology in the educational environment is widely considered to be a potential trigger for improving educational outcomes. The findings of this study suggest that technology-based learning plays an important role in providing flexible access to educational resources, especially in the context of university students. Based on the results, 75% of students reported that technology makes educational materials more accessible, leading to increased independent learning. This is in line with the findings of (Stansberry et al., 2019), who stated that digital learning tools expand access to knowledge, thereby supporting the development of competencies such as problem-solving and critical thinking (Stansberry et al., 2019). Likewise, Schneider et al., (2018) who emphasized that e-learning platforms can improve student engagement and learning outcomes by providing an interactive and personalized learning experience.

However, despite the perceived benefits, some challenges were encountered, especially regarding infrastructure and reliable internet availability. The findings of this study also show that 50% of respondents experience internet connectivity disruptions, which is a major barrier for students in rural areas. This confirms research by North et al., (2013) which discussed how digital infrastructure inequalities hinder effective education delivery, especially in developing countries . In addition, the digital divide remains a significant problem, especially in less developed areas, as revealed by the research of Garrison et al., (2010), which states that students in rural areas face challenges in utilizing digital tools effectively (Garrison et al., 2010).

In the context of village development, this study highlights the crucial role of technology-based learning in improving human capital in rural communities. By increasing access to quality education through e-learning platforms, students in rural areas can bridge existing education gaps, which can ultimately contribute to sustainable economic and social development at the village level. This can affect the local economy and encourage socio-economic progress through the upskilling of the workforce.

Challenges in the Implementation of Technology-Based Learning

The application of technology in education, while promising, presents significant challenges that hinder its full potential. One of the main barriers identified in this study is inadequate training provided to teachers on how to use technology effectively in the classroom. About 40% of respondents indicated that they felt unprepared to use the available digital tools, which is in line with the findings of previous research by (Schunk & DiBenedetto, 2016). Schunk emphasizes that the lack of technology-based teaching skills not only limits the effectiveness of digital tools, but also creates a gap in the pedagogical use of such tools (Schunk & DiBenedetto, 2016). This concern is also expressed by Bates, (2015) who

emphasizes that without proper professional development, technology adoption can remain superficial and underutilized.

In addition, 35% of respondents reported a lack of access to digital devices, especially in rural areas, where college students often rely on shared or outdated devices. This observation is in line with research by Hepp et al., (2004), which found that the gap in technology access between urban and rural areas exacerbates inequalities in education (Selwyn, 2020). Although the central government has made several efforts through programs such as "Digital Indonesia", challenges in infrastructure development and equitable access to technology across the country remain.

In village development, these challenges are very relevant. In rural areas, where access to technology is limited, the benefits of technology-based learning can be significantly reduced. Rural communities are often at a disadvantage in accessing educational resources, and without adequate infrastructure or training, the positive impact of technology can be hampered. Addressing these issues is critical to ensuring that rural workers are prepared to face the challenges of the digital economy, which is a crucial aspect of sustainable village development.

The Impact of Technology-Based Learning on Student Engagement

Student engagement in technology-based learning environments has become an important research area in education. The findings of this study reveal that although technology facilitates access to educational resources, it does not necessarily guarantee a high level of student engagement. The data shows that only 60% of students actively participate in online discussions, while 40% report a lack of engagement during online classes. This trend supports findings from previous research by Kozanitis & Nenciovici, (2023), which found that while technology can provide a platform for engagement, it does not necessarily encourage active participation without intentional teaching strategies (Kozanitis & Nenciovici, 2023). Likewise, Harasim, (2017) research on online learning platforms, which emphasizes that student involvement in a virtual environment requires special strategies to encourage active participation and collaboration (Harasim, 2017).

This research also revealed that student engagement was much higher in courses that used interactive elements such as quizzes, discussions, and collaborative assignments. This is in line with the work of Stansberry et al., (2019) who emphasizes that technology-based learning environments should be designed to promote student interactivity and engagement. In this context, the integration of interactive elements in learning platforms, such as gamification and collaborative tools, can increase student motivation and participation.

In village development, student involvement in technology-based learning is essential for rural youth to develop the skills needed to contribute to local economic growth. Engaged students are more likely to pursue careers in technology, entrepreneurship, and digital marketing, all of which are essential for rural economic development. Therefore, creating an engaging digital learning environment for rural students is an important step to build a skilled workforce that can drive village development initiatives.

Practical Implications of Technology-Based Learning for Village Development

The findings of this study provide several practical implications for policymakers, educators, and community leaders. One of the key recommendations is the importance of providing ongoing training to teachers to improve their digital literacy and teaching skills. This is in line with recommendations from previous research by Darling-Hammond, Hyler, & Gardner, (2017), which suggested that continuous professional development is essential for teachers to be able to adapt to the ever-evolving technological environment (Darling-Hammond et al., 2017). Additionally, equipping rural schools with adequate technological resources, including reliable internet access and digital devices, is critical to ensuring that rural students benefit from technology-based learning. This will help bridge the digital divide and ensure that rural areas are not left behind in the advancement of technology-driven education.

In addition, policymakers should prioritize the development of digital infrastructure in rural areas as part of a broader rural development strategy. As noted by Preece (2015), the development of digital infrastructure in rural communities can significantly improve access to education and open up opportunities for local economic development (Preece, 2015). By focusing on improving digital infrastructure in villages, policymakers can contribute to a more equitable education system and boost local economies through education and skills development.

From a village development perspective, this study highlights the importance of integrating technology in rural education systems as a way to increase human capital. By empowering rural students with the skills and knowledge needed for the digital economy, technology-based learning can play a crucial role in driving village development, fostering entrepreneurship, and improving livelihoods in rural communities.

Research Limitations

While this study provides valuable insights into the application of technology-based learning in rural areas, there are some limitations that need to be acknowledged. First, sample sizes were limited to only a few institutions in Indonesia, and therefore, these findings may not be fully generalizable to other regions or countries. In addition, the study relies on self-reported data by students and lecturers, which can lead to bias or inaccuracies in responses. Future research should consider a larger, more diverse sample to improve the generalization of the findings.

Another limitation is the short duration of observation periods, which may not fully reflect the long-term impact of technology-based learning on student engagement and academic outcomes. Longitudinal research that tracks students over a longer period of time will provide a more comprehensive understanding of the impact of technology on learning outcomes.

Finally, this study focuses more on the educational aspects of technology integration and does not fully explore the economic and social outcomes for rural communities. Future research should consider the broader impact of technology-based learning on rural development, including economic growth, employment opportunities, and social well-being.

CONCLUSION

This research aims to analyze how technology-based learning strategies can improve the quality of human resources (HR) in the context of national development, especially in rural areas. The key findings of this study show that technology-based learning has great potential to expand access to education and improve student skills, which in turn can contribute to improving the quality of human resources. Despite the challenges associated with digital infrastructure and the lack of training for lecturers, the majority of students feel that technology allows them to study independently and flexibly, which increases the efficiency and effectiveness of their learning. However, obstacles related to unstable internet connections in rural areas and limited devices in some institutions are factors that hinder the optimization of technology in education. In addition, the results of this study also highlight the importance of developing policies that are more adaptive to technological developments in the education sector, especially for rural areas. Technology-based learning not only has the potential to improve the quality of human resources at the individual level, but can also play an important role in supporting village development. By improving access to education through technology, students in rural areas can develop skills relevant to the needs of the digital job market, which can ultimately contribute to sustainable economic and social development at the village level. Therefore, to ensure maximum impact, there needs to be more attention to the provision of adequate infrastructure and ongoing training for teachers.

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