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Analysis of Teacher Pedagogical Competencies Using Digital Technology in Learning

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A B S T R A C T

Current technological developments expect teachers to be able to integrate digital technology into the learning process to improve the effectiveness and quality of education. This study aims to analyze the use of digital technology in learning. This research method is Descriptive and Quantitative use a questionnaire as an instrument. The population of this study was professional teacher education students at Malikussaleh University who were teachers as many 400 people drawn as a random sample. The study results showed that the pedagogical competence of prospective professional teachers was in the very high category in 91.352%, as many 30.83% of respondents chose to use video media as their teaching.

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INTRODUCTION

The Teacher Professional Education Study Program at Malikussaleh University is expected to be able to improve the professionalism of teachers around North Aceh. As a teacher and prospective professional teacher, Teacher Professional Education students have an obligation to pedagogical competence, especially in the use digital technology in learning. The Teacher Professional Education study program at Malikussaleh University consists of five fields of study Physics, Chemistry, Mathematics, Indonesian and Mechanical Engineering.

Students of the Teacher Professional Education Study Program are prospective professional teachers (Maryani & Martaningsih, 2017), re required to master pedagogical competence which not only includes mastery of material, but also the ability to utilize digital technology to improve the quality of learning (Satianingsih et al., 2024). Digital technology, such as e-learning platforms, learning applications, and online collaboration tools, can facilitate more interactive and effective teaching (Novita et al., 2021). For example, the use of Learning Management Systems (LMS) such as Moodle and Google Classroom has shown to increase student participation and enrich the learning experience of students (Muliani et al., 2022) (Sakdiah et al., 2022). However, there are still challenges, such as technical constraints, access to devices, and the readiness of teachers and students to utilize the technology optimally (Gesang Wahyudi & Jatun, 2024).

Studies show that the use of digital technology can improve learning motivation, student engagement, and learning outcomes (Permadi et al., 2020). For example, research shows that digital technology can help develop critical thinking skills (Agus Priadi et al., 2021) and creativity (Amalia et al., 2021) in students. In addition, research by (Abroto et al., 2021) confirms that hybrid learning (blended learning) that combines digital technology with face-to-face learning shows better learning outcomes compared conventional learning. So use digital technology is one of the pedagogical skills that a teacher must have.

An analysis of the use of digital technology in the learning of Teacher Professional Education students is needed to provide a clear picture of the extent to which this technology is utilized in the context of teacher professional education. This is important to know what digital technologies are currently being used, the challenges faced, and opportunities for developing digital competencies for prospective professional teachers, especially in certain fields of study. Several studies emphasize the importance of a more personalized approach in the use of digital technologies to ensure optimal learning outcomes (Ambarwati et al., 2021).

By understanding the use of digital technology in learning, it is hoped that recommendations can be produced for the development of a more relevant and contextual PPG curriculum, as well as effective training strategies for prospective teachers so that they can optimize the use of digital technology in their classrooms in the future.

LITERATURE REVIEW

Digital Technology in Learning

Digital technology has become an important part of the world of education, influencing the way teachers teach and students learn (Syahputra, 2018). Digital technology in learning refers to the use of electronic devices, software, and digital resources to support the education process. Digital technology can include various tools such as computers, the internet, learning applications, and Learning Management System (LMS) platforms that are used to improve interaction, access to information, and the effectiveness of the teaching and learning process (Lestari, 2013).

Learning Theories that Support the Use of Digital Technology

Several learning theories underlie the use of digital technology in Education as explained by (Nirmaisi Sinaga et al., 2024) and (Warini et al., 2023) in their articles:

a) Constructivism Theory: According to Piaget (1976) and Vygotsky (1978), constructivism emphasizes that learning is an active process in which learners construct their own knowledge through interaction with the environment. Digital technologies, such as interactive simulations and multimedia, support constructivist learning by enabling independent exploration and discovery.
b) Cognitivism Theory: This theory focuses on how information is processed and stored in the mind. Mayer (2009) states that well-designed educational multimedia can improve understanding and retention of information through dual-channel processing (visual and verbal).
c) Social Learning Theory: Bandura (1986) suggests that learning occurs through observation and imitation. Digital technologies such as instructional videos and collaborative platforms enable effective social learning models.

Challenges of Using Digital Technology in Learning

Despite its many benefits, the use of digital technology in learning also faces various challenges, including: Technical Readiness and Infrastructure: Not all educational institutions have adequate technological infrastructure, such as a stable internet connection and adequate hardware. Teacher Ability and Readiness: Teachers need to have sufficient digital competence to integrate technology into the learning process. Lack of training and technical support can hinder the effectiveness of technology use. Costs and Resources: Implementing digital technology often requires significant investment in hardware, software, and teacher training. Resistance to Change: Some teachers and institutions may be resistant to changing conventional learning methods to more technology-based methods (Nur Syifa et al., 2024).

METHODOLOGY

This research was conducted at the Teacher Professional Education Study Program, Malikussaleh University, with students of the Study Program as the population and samples taken randomly as many as 400 students. The instrument used is an online questionnaire will be used as a data collection instrument. This questionnaire will consist of closed questions about the type of digital technology used, frequency of use, and perceptions of the effectiveness of the technology. Data Processing: The quantitative data obtained will be analyzed using descriptive statistics, such as frequency, percentage, and average.

Analysis of the level of use of digital technology and the learning effectiveness questionnaire is calculated using the percentage index as follows.

$$\% = \frac{Score\ obtained}{Maximum\ score} x\ 100\%$$

The percentage results are then compared to the following criteria.

Table 1 Criteria for pedagogical competence levels

No	Percentage (%)	Pedagogical Competence Levels
1	≥81	Very High
2	66 – 80	High
3	46 – 65	Quite High
4	≤45	Low

RESEARCH RESULT

This study aims to analyze the level of pedagogical competence of prospective professional teachers in the use of digital technology in learning by teachers. The results obtained are as follows.

Table 2 Average use of technology in learning

No	Indicator	Value	Percentage
1	Use of Technology	4,454	89,072
2	The Role of Technology in Learning	4,830	96,862
3	Effectiveness of Technology in Understanding	4,830	96,606
4	Effectiveness of Technology in Learning	4,613	92,252
5	Training Needs	4,547	90,950
6	Support Facilities	4,118	82,369
	Average	**4,565**	**91,352**

Table 2 shows that prospective professional teachers have used technology in learning with a very high category of 89.072%, but there is still room for improvement so that the use of technology can reach its maximum potential in all aspects of learning. The role of technology in learning is also in

the very high category of 96.868%, This score indicates that technology has succeeded in making a significant contribution, for example by supporting interaction or expanding learning resources. The effectiveness of technology in student understanding is in the very high category of 96.606%, this percentage reflects that digital media facilitates student understanding better than conventional methods. The effectiveness of technology in learning is in the very high category of 92.252%, this shows that it facilitates more efficient and interactive learning activities. For training needs, it is at 90.95%, this shows that there is still a need for training for teachers or educators so that their competence continues to develop. While financial support gets the lowest score but is still in the very high category of 82.369%, this shows that even though technology has been implemented, infrastructure and facilities need to be improved to support the smooth running of the digital-based learning process.

Overall, the data shows that technology has been utilized well in learning, with an average percentage of 91.35%. However, facility support needs to be considered more seriously, because infrastructure plays an important role in supporting the sustainability of technology-based learning. In addition, although the results are good, routine training needs to be improved so that teachers can continue to adapt to the latest technological developments.

The types of media chosen by respondents can be seen in the following picture.

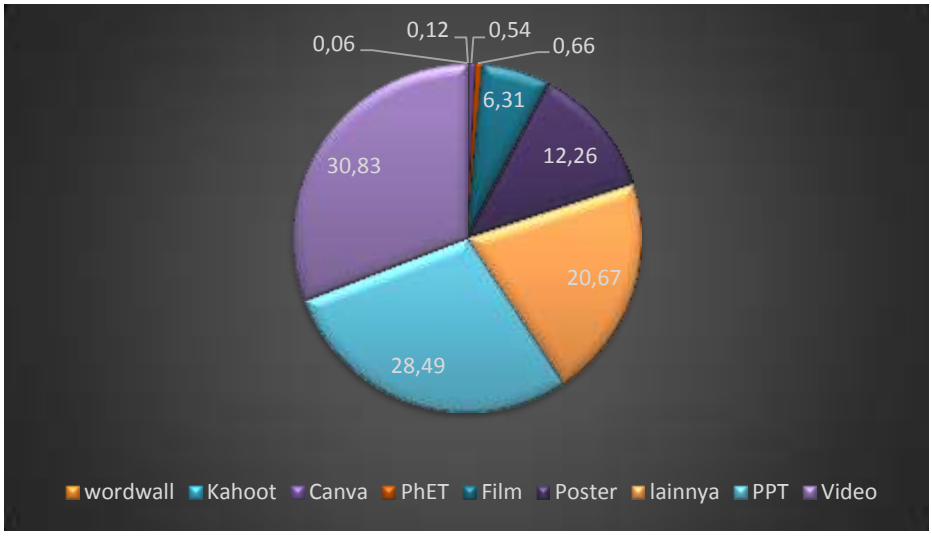

Figure 1 Types of media frequently used by prospective professional teachers

Based on the first figure, it is found that the media most chosen by respondents in the learning process is video, which is 30.83%. Then followed by powerpoint (PPT) as much as 28.49% other media as much as 20.675. While the least used media is wordwall which is only 0.06%. Prospective professional teachers are more comfortable using video and PPT media because material in the form of abstract concepts will be conveyed more realistically if displayed in the form of video and PPT.

DISCUSSION

Based on the data presented, there are six indicators that measure how effectively technology has been applied in learning activities. Several aspects require further attention to achieve optimal results. Here is a more in-depth analysis per category.

1. Use of technology
   Technology has been utilized significantly in learning activities. The percentage of 89.072% shows that teachers and students are accustomed to using technology. However, to achieve maximum utilization, it is necessary to increase consistency in the use of technology in various subjects and levels of education. To maximize the use of technology, it is necessary to socialize the use of digital platforms evenly in all classes.
2. The Role of Technology in Learning
   Technology has proven to be very important and essential in supporting the learning process. The percentage value of 96.862% shows that technology is not just an addition, but a crucial part in increasing learning effectiveness. Teachers and students feel a positive impact, both in the availability of information and more flexible interactions. To maximize the role of technology, learning is done by increasing creativity in the use of technology, such as utilizing VR, simulation, or gamification as well as strengthening the understanding that technology must continue to be integrated to be relevant to changing educational trends.
3. Effectiveness of Technology in Understanding
   Technology has helped improve students' understanding of learning material. The value of 96.606% indicates that digital media facilitates deeper understanding than conventional methods. Material that was previously difficult to understand may become clearer thanks to the use of interactive technology. What needs to be done to maximize this point is to develop interactive digital learning content, such as educational videos or simulations and carry out regular evaluations to identify which material is most effectively taught using technology.
4. Effectiveness of Technology in Learning
   The use of technology has proven to be effective in the overall learning process. This effectiveness can be seen from the value of 92.252% which can refer to various aspects, including time efficiency, access to information, and student involvement. This value shows that the teacher has succeeded in integrating technology in teaching and learning activities. What needs to be done to maximize this point is to ensure that all teachers can adopt equally effective methods and

expand the scope of technology used, such as AR/VR-based learning tools.

5. Training Needs
   Even though the results of using technology are good, the need for continuous training is still high, namely 90.950%. Training needs indicate that teachers need to regularly upgrade their skills to keep up with the latest technological developments. This is critical for technology implementation to remain relevant and effective. So it is necessary to hold scheduled workshops and training and encourage teacher participation in online communities and courses related to educational technology.
6. Facilities Support
   Facility support is the lowest factor compared to other indicators. Even though technology has been well adopted, there are still limitations in supporting infrastructure or facilities. This may be hardware limitations, internet connection, or lack of access to certain apps and learning platforms.

In general, the data shows that technology has been used well and effectively in supporting learning, with an average score of 91.352% or the very high category. However, there are several key factors that need to be improved to ensure the application of technology can reach optimal levels. The use of digital learning media as a form of innovative learning in learning is because it provides benefits for both teachers and students. Digital learning media must also be balanced with the teacher's ability in the field of technology (Ginting et al., 2024) because digital media is very dependent on technology such as laptops and cellphones (Dwi Adventyana et al., 2023).

The media most often used by prospective professional teachers are video and PPT media. This is because videos are able to explain abstract or complicated concepts more clearly through animations, images and simulations that cannot be explained effectively with text or static images (Sakdiah, 2022). Video media is also more interesting because it is a combination of audio and visual media which can be played repeatedly if students still don't understand (Defianti et al., 2022). So that it is able to support an effective, flexible and interesting learning process for students.

CONCLUSIONS AND RECOMMENDATIONS

The results of this research show that the pedagogical competence of prospective professional teachers is in the very high category, namely 91.352%, this shows that the use of technology has become something very important in learning. The media most often used is video media, to make it easier to explain abstract material that is difficult to explain with words.

ADVANCED RESEARCH

Research may only focus on evaluating technology use in the short term. Long-term impacts, such as changes to student learning outcomes or sustainability of technology adoption, may not be well measured. Further research could focus on increasing respondent coverage, long-term monitoring, or expanding the types of technology analyzed so that the results are more comprehensive and relevant.

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