The Use of Technology in the Development of Teacher-Teaching Competency Pedagogy in 21st-Century Learning

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ARTICLE INFO	ABSTRACT
	The development of pedagogic skills of teachers in the 21st century is a very important need. Pedagogic abilities that need to be developed are teachers' ability to master technology, technology is one of the competencies that can help teachers develop effective and efficient learning. Education can harness the potential of technology in pedagogics to create innovative, interactive, and effective learning. Professional development of teachers is also important so that they can become competent facilitators of learning in the digital. **Keywords:** Technology, Pedagogy, Development.

INTRODUCTION

Education is one sector that continues to grow along with technological developments. The use of technology in education has become a topic of increasing interest, especially in the pedagogic context of teacher competence. [1] Stating teacher competence is the ability of a teacher to carry out obligations responsibly and appropriately. Teachers who have strong pedagogic competence have an important role in improving the quality of learning and student learning outcomes. Permendiknas No. 17 of 2007, concerning the competence of elementary school teachers. The competencies that must be possessed by teachers are pedagogic, social, professional, and personality [2] Teacher competence However, one of the standards of academic qualifications and competencies that must be possessed by teachers in Indonesia is to be able to use information and communication technology for the benefit of learning [3]

In the ever-evolving digital age, the use of technology in education has become increasingly important. Teachers as leaders in the classroom play a crucial role in shaping the student learning experience. Therefore, it is important for teachers to continuously develop their pedagogic skills to be able to face the challenges and opportunities offered by technological developments.

The use of technology in various aspects of life requires teachers to master the technology so that there is no gap between teachers and students in the technological era. Mastery of technology in the learning process will create an active and creative learning process [4]

In the 21st century and the era of society known as the era of super smart society the use of technology in learning is needed, technology can be used by teachers to improve the quality of teaching, and assessment, technology has also helped teachers in terms of training and professional development, collaboration and sharing with fellow teachers, digital learning resources, adaptive learning, evaluation and feedback, and data analysis [5]Technology can change the way teachers teach and interact with their students. This is supported by the Minister of Education and Culture of the Republic of Indonesia, guidelines for the use of technology in teacher pedagogy competency development, including the use of online platforms, mobile applications, and digital learning aids. Digital schools offer many

advantages offered by several prestigious schools, where digital schools take advantage of technological advances and the use of the Internet, the use of Internet access frees access to any information, according to Nolan [6] revealed in the field of Internet education has played an important role in learning. Students in the digital age coexist with technology, a technology used in everyday life, Echenique, et al. call today's students digital learners, assuming that students have been so influenced by information technology that we should think of them as "digital". They understand technology because they think and process information differently than previous generations. In the learning process, students are very close to the use of technology, how the use of the internet in Education, the use of Augmented Reality (AR), and the use of artificial intelligence (AI) so that the learning experience of participants becomes wider.

However, the use of technology in pedagogic or digital pedagogics becomes one of the competencies that teachers must have, technology can present a wider learning experience according to [7] Technological advancement has revolutionized educational opportunities, disrupting conventional teaching methods in schools and universities. This contemporary learning environment enables people of all ages to pursue education according to their preferences, whether from their homes, libraries, internet cafes, or workplaces. Learners have the autonomy to select their desired content, study schedule, and learning methods. This shift in educational paradigms, which can occur anywhere, presents a crucial challenge and required competency for educators in the digital age to remain relevant and connected with current generations. Some of these challenges include limited infrastructure and equitable access to technology, lack of teacher technology knowledge and skills, and paradigm shifts in learning with technology. According to [8]said the challenges teachers face in technological development are knowledge challenges, confidence challenges, belief and attitude challenges, and school culture challenges. Knowledge gaps in the use of technology in teaching result in difficulties for teachers.

Therefore, research and literature review on the use of technology in pedagogic teacher competence becomes relevant to gain a deeper understanding of how technology can be used effectively in improving teacher competence and quality of learning. Thus, this study aims to present a comprehensive literature review on the use of technology in pedagogic teacher competence, as well as highlight the opportunities and challenges that arise in adopting technology in the context of Education.

METHODOLOGY

This research is based on the results of scholarly books, academic journals, and various literature analyses. The methodology employs a comprehensive literature review approach, examining relevant books, published materials, and documented research related to the topic under investigation [9]. According to[10] and [11]Scholars have established that literature-based research serves as a foundational support, incorporating expert perspectives found in reference materials, academic publications, research findings, and other scholarly documentation.

RESULTS & DISCUSSION

Pedagogics and Teacher Competence

Pedagogics refers to the study of learning and teaching processes. It involves an understanding of the principles, theories, and methods of education aimed at achieving effective and efficient learning. Pedagogics focuses on how teachers plan, execute, and evaluate learning, as well as how students acquire knowledge, skills, and attitudes through interaction with teachers and the learning environment. According to Dewey (1938) [12] said education should be centered on real experience and relevant to students, teachers should not only convey information but should also be facilitators who help students learn through active interaction with their environment. Teacher pedagogics help teachers create learning environments designed by teachers according to student needs in terms of learning methods, classroom management, assessment and evaluation, interpersonal relationship communication, and understanding lifelong learning for teachers, teachers continue to develop their competencies through experience and professional development. According to [13] teachers must have the ability to manage classes well, be able to establish good relationships with students, be able to use technology in the learning process to create a comfortable, creative, innovative, and effective learning atmosphere. Teacher competence involves the ability of teachers to continue learning, keep up with the latest developments in education, and develop themselves on an ongoing basis. To be a competent teacher, a teacher needs to understand and apply relevant pedagogic principles in his teaching practice. Pedagogic understanding of teachers helps in the development of teacher competencies which include effective

teaching skills, good classroom management, appropriate assessment, effective communication, and commitment to lifelong learning (14).

Teacher competence refers to the set of knowledge, skills, and attitudes required by a teacher to carry out his duties and responsibilities effectively. Teacher competence covers various aspects, including the ability to plan and structure appropriate learning, manage classes, demonstrate teaching skills, use effective teaching strategies, evaluate student progress, communicate well, and have an understanding of the relevant educational context. Teacher competence also includes the ability to use educational technology effectively, adapt to changes in curriculum and pedagogy, work collaboratively with colleagues and parents, and have a professional attitude in developing themselves sustainably and innovating in teaching practice. Teacher competence is an important foundation for providing high-quality learning and influencing student learning outcomes [15].

The Role of Technology in Pedagogics

The development of technology has had a major impact on the field of education. Educational technology has evolved rapidly, including the use of hardware such as computers, laptops, tablets, and mobile devices, as well as software such as applications, online learning platforms, and learning support software. Technology has a role and influences pedagogic abilities that must be mastered by teachers [16]

In addition, there have also been advances in networking technology and the internet, allowing access to extensive educational resources and collaboration between teachers and students online. Technology also continues to experience developments such as artificial intelligence, virtual reality, augmented reality, and wearable technology that are increasingly applied in educational contexts.

Benefits of Technology in Education

The use of technology in pedagogics can provide significant benefits in Learning [17], among others:

1. More interactive and engaging learning: Technology enables the use of multimedia, animation, video, and gamification that makes learning more engaging and interactive for students.

2. Personalized learning: Technology can facilitate adaptive learning, where students can learn at their own pace and learning style.

3. Access to extensive educational resources: Technology enables access to online educational resources such as e-books, scientific journals, learning videos, and digital learning platforms that enrich learning materials.

4. Better collaboration and communication: Technology allows students and teachers to communicate and collaborate online through discussion forums, project groups, and virtual collaboration tools.

5. Effective monitoring and assessment: Technology can be used to monitor student progress in real-time, provide rapid feedback, and present analytical data for learning evaluation.

Technology Challenges in Education

The use of technology in pedagogics is also faced with challenges and opportunities, among others:

1. Infrastructure and accessibility: Challenges related to technology infrastructure and accessibility in different regions and environments can be barriers to applying technology in learning.

2. Teacher training and skills: Teachers need to have sufficient understanding and skills in the use of technology to maximize its benefits in learning.

3. Security and privacy: The use of technology in learning requires good policies regarding the security and privacy of student and teacher data.

4. Learning paradigm shift: The use of technology requires a paradigm shift in the learning approach

Use of Technology in Improving Teacher Competence

Technology can be used to improve teacher competency skills. the following technologies are used to support teacher competence(17).

1. Teacher Training and Professional Development through Technology: Technology can be used as a tool to train and develop teacher competencies. Training and professional development can be done through online learning platforms, webinars, or e-learning programs that include material on the use of technology in learning. Teachers can access digital resources such as video tutorials, online modules, and discussion forums to deepen their understanding of technology and develop necessary skills.

2. Utilization of Apps and Software in Managing Learning: Teachers can take advantage of a variety of apps and software to help manage their learning. Digital classroom management apps, for example, can assist teachers in organizing assignments, keeping student records, and providing feedback efficiently. In addition, learning material creation software, such as presentation apps or interactive content creators, can be used to create engaging and interactive materials for students.

3. Use of Interactive and Multimedia Learning Media: Modern educational technology enables teacher to employ diverse interactive and multimedia teaching resources, encompassing video-based instruction, digital simulations, animated presentations, and gamified learning elements. These technological tools allow teachers to develop engaging educational experiences, illustrate abstract ideas visually, and deepen student learning through interactive visual engagement.

4. Utilization of Digital Learning Resources to Improve Teacher Competence: Teachers can utilize digital learning resources, such as e-books, scientific journals, video tutorials, and other online resources, to improve their competence in a particular field. By accessing these resources, teachers can keep their knowledge updated, keep up with the latest trends, and gain diverse perspectives in education.

5. Collaboration and Connectedness between Teachers through Technology: technology enables collaboration and connectedness between teachers online. Through collaborative platforms or educational social networks, teachers can share experiences, ideas, and learning resources. They can engage in discussions, collaborate on joint projects, or provide each other with support and feedback. This collaboration can improve teacher competence through the exchange of knowledge and best practices.

By utilizing technology in these ways, teachers can improve their competence in teaching and provide a better learning experience for students.

Technological Developments Continue and in the Future

There will be new opportunities and challenges in the use of technology in pedagogics. Some of the technological developments that can be anticipated are:

1. Artificial Intelligence (AI): AI can provide great potential in supporting adaptive learning, pattern recognition, automated assessment, and the development of virtual assistants that can provide personalized assistance to students.

2. Internet of Things (IoT): IoT enables the integration of devices and sensors that can be used in learning environments, facilitating data collection and analysis to understand student behavior and needs more deeply.

3. The implementation of VR and AR technologies facilitates deeply engaging educational experiences, offering learners the ability to conduct comprehensive investigations and participate in immersive simulations through interactive digital environments.

4. Mobile Learning and App-Based Learning: The use of mobile devices and learning applications continues to grow, enabling flexible and personalized access to learning outside the school environment.

The Need for Teacher Competency Development in the Digital Age

In the digital era, teachers need to develop new competencies to optimize the use of technology in learning. Some of the needs for teacher competency development in the digital era [18]

1. Deep Understanding of Technology: Teachers need to have a deep understanding of various technologies relevant to learning, including artificial intelligence, IoT, virtual reality, and learning applications. They must keep abreast of the latest technological developments and understand their potential and application in educational contexts.

2. Innovative Learning Design Skills: Teachers need to develop the ability to design innovative learning using technology. They should be able to integrate technology into effective and engaging lesson plans.

3. Digital Skills and Information Literacy: Teachers need to master basic digital skills and information literacy to be able to use technology effectively, search, evaluate, and use information wisely.

4. Digital Classroom Management Skills: Teachers need to develop the ability to manage digital classrooms, including managing device access and use, facilitating online collaboration, and encouraging students' active participation in the digital environment.

5. Continuous Professional Development: Teachers need to continuously develop themselves through training and professional development to keep abreast of technological developments and best practices in the use of technology in learning.

By developing these competencies, teachers can harness the potential of technology to improve learning and provide a better learning experience for students in the digital era [19].

CONCLUSION

In this literature review article, some important findings on the use of technology in pedagogics can be summed up.

1. Technological developments in education continue at a rapid pace, including the use of hardware and software that supports learning.

2. Technology in learning has significant benefits, including more interactive learning tailored to individual needs, access to extensive educational resources, better collaboration and communication, and effective monitoring and assessment.

3. The use of technology in pedagogics is also faced with challenges such as infrastructure and accessibility, teacher training and skills, and security and privacy.

These findings have important implications for teachers' education and professional development: education needs to constantly adapt to technological developments to ensure relevant and effective learning. Teachers need to develop competencies in using technology in learning, including an in-depth understanding of technology, innovative learning design, digital skills, information literacy, digital classroom management skills, and continuous professional development. Improved infrastructure and technological accessibility are also important to ensure equal access to education for all students. In addition, security and privacy-related policies and measures need to be considered to protect student and teacher data. By taking these findings into account and implementing appropriate measures, education can harness the potential of technology in pedagogics to create innovative, interactive, and effective learning. Professional development of teachers is also important so that they can become competent facilitators of learning in the digital age**.**

Data Availability:

This research did not involve the generation or analysis of novel datasets. Therefore, data sharing protocols are not relevant to this publication.

Conflict of Interest:

The authors declare that there is no conflict of interest.

Miscellaneous:

Any figures, tables, supplements, appendices, or annexes that are placed after the reference. Must include text citations for them in the body of the manuscript.

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