Leveraging Technological Innovation in the Learning Process: Increasing Accuracy, Engagement, and Learning Outcomes

Iron Maulana Fadilah [1], Deva Rizkia Fitriana [2], Bakti Fatwa Anbiya [3]

[1] UIN Walisongo Semarang, Indonesia
[2] UIN Walisongo Semarang, Indonesia
[3] UIN Walisongo Semarang, Indonesia
CORRESPONDENCE: ✉ ironwalisongo@gmail.com

Abstract

This study aims to 1) Describe technological innovation in the learning process, 2) Utilize technological innovation in the learning process, 3) Increase accuracy, engagement and student learning outcomes. This research uses qualitative methods with a library research approach. Data collection techniques by collecting books and scientific journal articles that are accurate and relevant to the topic being discussed. The collected data was analyzed using the Miles and Huberman model through the stages of data reduction, data presentation, and drawing conclusions/verification. Then the data validation technique involves triangulation techniques, namely checking and establishing validity by analyzing data from various perspectives. By using this triangulation technique, the data studied is complete and valid.

This study shows that technological innovation has brought major changes to the world of education. This is reflected in increased accuracy in understanding the material, student engagement, and good learning evaluation results. The use of technology allows for personalization of learning, online collaboration, and the use of gaming elements to improve the quality of education. Despite challenges such as technology accessibility, the role of teachers remains important in providing guidance and motivation to students. By combining technology with strong pedagogical principles, we can create more effective and inclusive education.

Introduction

Innovations in learning technology have opened up wider access to those who may have previously struggled to obtain formal education, such as online courses, webinars and distance learning platform. Technologies such as educational games, interactive learning platforms, and instructional videos have increased student engagement. This helps students stay engaged in their learning. Technology also enables personalized learning, where students can take courses tailored to their skill level and interests. We are currently entering the era of the industrial revolution, where rapid technological development is the gateway to the emergence of the 4.0 industrial revolution (Reflianto & Syamsuar, 2018: 5). The era of industrial revolution changed the way of thinking and perspectives in education, such as the learning achieved when the use of technology became more widespread (Rahman & Nuryana, 2019: 13).

The ever-evolving nature of the digital economy makes it mandatory individuals quickly adapt to shifts in demand for skills and technology changes. Teachers also need to have a friendly, collaborative, creative and courageous attitude risks, and carry out comprehensive learning so that the learning process continues optimal and remains student-centered (Rahman & Nuryana, 2019: 14). Utilization of educational technology (Education Technology) or whatever term is used: technology for education (Technology for Education), information technology (Information Technology/IT), or communication and information technology (Information and Communication Technology/ICT) is believed to be one way strategically address the main problems faced, such as improving quality and expanding learning opportunities (Arief, 2007:82-83). Teachers can use technology to manage classes more efficiently, provide faster feedback, and plan better instruction. This can help teachers improve the quality of their teaching (Sudarman, 1994:2).

Despite the great benefits of using technology in learning, there are still gaps in access in various communities. Some students may not have reliable devices or internet access, and thus face difficulties in participating in online learning. Evaluation in learning is also changing with technological innovation. There is a shift from paper-based evaluations to computer-based assessments, which can provide more accurate evaluation results. The use of technology in learning also raises the need for better development of technology skills among students and educators. Educational technology is defined as a systematic way of designing, implementing and evaluating the entire teaching and learning process, in relation to specific objectives and based on the principles of learning and communication that occur in humans, and utilizing various human and non-human sources with the aim of more effective teaching.

To innovate requires a strategy. Several countries are already aware of this the need for a strategy to increase innovation that contributes to the world of education, an example is the strategy used by the Hungarian State which is called Hungarian National Education Sector Innovation System (NESIS) (OECD, 2016: 27). Hungary emphasized its existence involvement of key parties to develop innovation in education. Educational innovation too seen in Singapore which applies STEM (Science, Technology, Engineering, Mathematics) (Kristien, 2019). Therefore, it can be said that in developing a strategy To develop educational innovation it must be done comprehensively. Strategy for developing educational innovations must be well designed and able to exploit potential existing ones such as technological advances.

Research has shown that the use of technology in learning can increase student engagement. This can be achieved through the use of educational games, online learning platforms, or other interactive tools that motivate students to actively participate in their learning. Technology enables

personalization of learning by adapting learning materials and methods according to each student's level of understanding and learning style. This helps increase accuracy in the delivery of learning materials, so that the learning process allows teachers to collect richer and more accurate evaluation data. With the help of technology, students can also access extensive and varied educational resources, including learning videos, simulations, online tutorials, and various other supporting resources that can improve their understanding.

Technology enables easier collaboration with students and educators around the world. This helps students develop a deeper understanding of global issues and communicate with individuals from different cultures. Education in the future will belong to those who can utilize technology (education and teaching/instruction). Teachers can monitor student progress in real-time through online learning platforms, enabling them to provide faster and more precise feedback. The use of technological innovation in learning has had a significant impact in improving the quality of education and helping students reach their maximum potential. Data and findings from the literature show that this approach has great potential to improve accuracy, engagement, and evaluation results in the learning process.

The main problem faced is the difficulty of developing scientific knowledge can shed light on practice. Teacher practice and willingness to learn and Keeping up with existing developments is the key to creating effective learning and efficient (Purnasari & Sadewo, 2020: 8). Therefore, this research aims to identify various technological innovations that can be applied in the learning process to increase the accuracy of delivering learning material. One of the main aims is to explore how technology can be used to increase student engagement in learning. This includes the use of interactive tools, online platforms, or learning applications that can make learning more interesting and relevant for students. As well as to evaluate the effectiveness of various technological innovations in improving student evaluation results. This includes comparing student learning outcomes before and after implementing certain technologies in the learning process.

Thus, the aim of this research is to explore the potential for using technology in education to achieve better accuracy, engagement and evaluation results, as well as contributing to the development of more modern and efficient learning methods. This research is very important because it contributes to our understanding of how technology can change and improve the learning process, which in turn will have a positive impact on education and student development. Based on this, the researcher wants conduct a literature study related to the role of educational innovation in learning based on digital technology.

Method

This research is qualitative research using descriptive analysis techniques with literature review. Researchers want to describe phenomena that are ongoing or have already occurred. The research was carried out in September 2023. The data collected came from scientific journals related to educational technology innovation. The data obtained was then analyzed using descriptive analysis methods. The analytical method used is by describing facts from theoretical studies resulting from research that has been carried out by previous researchers. This article analyzes the role of educational innovation in digital technology-based learning.

Result and Discussion

There is an obligation to adapt learning methods to the demands of the current era in the world of education. Academics always prioritize the learning process. Meeting science and technology (IPTEKS) standards is still a challenge for educational institutions. Therefore, the use of educational technology is very important and is the main focus in the world of modern education. The goal is to update and incorporate technology into learning. An additional goal is that educational technology can help students overcome problems that arise during learning (Titsa Raky Andjani 2018).

Learning technology is a very general and open approach. Nowadays, technology is also used to improve the learning process. However, the extent to which processes and benchmarks in teaching outcomes are specific to the goals that have been achieved is still unknown. In some ways, learning technology makes the difference in how likely the outcomes are that are critical to success in learning nearly impossible. On the other hand, it is possible that learning technology indicates the methods or techniques that can be used. Educational engineering is a theory consisting of several hypotheses and is used as a movement in education. Teachers have joined this movement because they believe that teaching has been done haphazardly and without a solid foundation. Therefore, educational technology is a serious effort to perfect teaching methods using scientific principles that have proven successful in other fields. (Ali and Erihadiana 2022)

Technology is the science of how to create an object or system. Some definitions related to technology:

1. Technology as knowledge that is applied practically and systematically, which relies on experiments or scientific theories. This allows humans to create products or services using productive skills (Seattler, 2004:4).

2. In the context of learning, technology refers to the emphasis on applying modern educational theories and the use of tools to design learning environments efficiently and effectively (Cheung, 2003: 525).

3. thoughts created by tools realized from technology (Siemens and Tittenberger, 2009:14)

According to the AECT Commission (Association for Educational Communication and Technology), technology is a complex and integrated process that involves individuals, processes, ideas, devices and organizations to analyze problems, find solutions, take action, evaluate and manage problem solving. for all aspects of human learning. On the other hand, there is a view that educational technology is progressive and is a tool designed to improve and support the human learning process..Sushanti (2013)

Technology in education today allows students to overcome geographic barriers, access educational resources from anywhere in the world, and learn remotely. Students have the flexibility to take classes whenever they want thanks to various online learning platforms. Additionally, artificial intelligence (AI) has changed the way learning is viewed with its ability to identify individual learning needs and provide tailored recommendations. Technology has also brought deeper learning concepts through the use of Virtual Reality (VR) and Augmented Reality (AR), which allow students to explore historical places and interact with 3D objects in the real world. According to Patmanthara (2012:28), the development of information and communication technology (ICT) has progressed very rapidly in recent years. This is motivated by the emergence of the era of globalization, where computers and the internet, which have a dynamic nature, have dominated various activities of daily life, and the use of these facilities has become important in all fields, including educational activities. This is because

As mentioned by Kartilawati and Mawaddatan Warohmah (2014: 144), in carrying out their duties, teachers must have various abilities and skills in line with the development of the digital era. This is based on the understanding that these abilities and skills are essential needs in the teaching profession. Furthermore, teachers need to adapt to these changes, because if not, they could fall behind and become obsolete. The main key to educational progress is the ability of teachers to manage and innovate every learning process they teach. Teachers are expected to continually strive to improve and update their skills continuously. This is in line with Wartomo's statement (2016: 266), which indicates that teacher competence must be in line with developments in information and communication technology and the current digital society.

Although challenges such as ethical use of technology and involving teachers in the development of this technology still exist, learning technology innovation continues to unlock new potential. With technology, inclusion in education has also become more possible, with increased accessibility for people with disabilities and students speaking different languages. However, it is important to remember that technology is only a tool, and the teacher's role remains very important. Teachers can provide the guidance, motivation, and personal approach needed to ensure

that students truly understand the material. Through collaboration between technology and humans, we can create better education, which combines the advantages of technology with human wisdom and care.

Conformity in the learning process is a key element to achieve effective learning. By ensuring that teaching methods, curriculum and learning materials suit the needs and characteristics of students, learning can become more relevant and meaningful for them. Apart from that, suitability also involves the use of a variety of teaching strategies that can accommodate different learning styles, so that each student has the same opportunity to succeed in the learning process. Thus, conformity in the learning process is an important foundation for achieving optimal learning outcomes and ensuring that each individual can develop their potential to the maximum by referring to achieving understanding of the material, student involvement, and learning outcomes.

1. Accurate understanding of the material

The use of technology in education has had a positive impact in terms of accurate understanding of the material. One significant innovation is the ability to personalize learning. With the help of advanced artificial intelligence (AI) algorithms, online learning platforms can customize learning content and difficulty levels according to each student's individual needs. This means that each student can learn at a pace and learning style that suits them, which in turn increases the level of accuracy of understanding the material. Additionally, technology also facilitates the use of various multimedia resources, such as interactive videos and simulations, which have the ability to explain complex concepts in a way that is easier for students to understand. Thus, technology has opened the door to a more precise and effective learning experience for students, promoting a deeper and more sustainable understanding of learning material. Nurdyasnyah, N., & Andiek, W. (2015).

Accurate understanding of material in an educational context is a crucial aspect in assessing the effectiveness of the learning process. Education expert, Dr. John Hattie, in his famous study of the "Size Effect" in education, highlighted the importance of accurate understanding of material. According to Hattie, to achieve deep understanding, students must be able to connect subject matter with previous knowledge, stimulate critical questions, and integrate new information with what they already know. Therefore, accurate understanding of material is not just memorizing facts, but rather understanding the underlying concepts. Technology, as Hattie and many other education experts have recognized, can play an important role in increasing the accuracy of understanding material. With artificial intelligence algorithms that can create learning plans tailored to each student's needs, technology enables unprecedented personalization of learning. This allows students to learn at a pace and style that suits them, which in turn can improve understanding of

the material. In addition, the use of multimedia in learning, such as interactive videos and simulations, has proven effective in explaining difficult concepts in a way that is easier for students to understand. This helps students to understand the material more deeply, because visualization and interactive experiences can make abstract concepts more real and concrete Budiana, H. R., Sjafirah, N. A., & Bakti, I. (2015).

Overall, the opinions of education experts, including Dr. John Hattie, suggests that technology can play a key role in increasing the accuracy of understanding material in education by allowing for personalization of learning and the effective use of multimedia. However, it remains important for educators to design appropriate learning experiences and support students in developing critical thinking skills and deep connections to learning material. Zayyadi, M., Supardi, L., & Misriyana, S. (2017).

2. Student Involvement

One of the main challenges in education is maintaining the involvement of students, who are now increasingly required to be more active in the learning process. A learner-centred or student-centred approach is essential, where the teacher's role is crucial in helping students overcome difficulties that may arise during learning (Antika, 2014). Technological innovation has provided solutions to these challenges in various ways. Online learning platforms, for example, provide interactive features such as discussion forums, online quizzes, and learning games that can make the learning process more interesting. Technology has also enabled the adoption of project-based learning, where students can collaborate online to complete tasks that are challenging and relevant to the real world. All of these innovations contribute significantly to increasing student involvement in learning Nurdyasnyah, N., & Andiek, W. (2015).

Student involvement in the learning process is an important aspect in creating an effective educational environment. Dr. Richard M. Ryan and Dr. Edward L. Deci, two experts in educational psychology, developed the theory of Self-Determination Theory (SDT) which underlines the importance of intrinsic motivation in motivating students. According to this theory, students are more involved and actively participate in learning when they feel they have autonomy in choosing and organizing their assignments, feel competent in completing assignments, and have good relationships with their teachers and friends. Azizah, Y. (2023).

In the era of information technology, education can utilize digital innovation to increase student engagement. The use of online learning platforms and interactive educational applications allows students to learn independently and design learning experiences according to their preferences. Additionally, technology also enables the use of collaborative project-based learning

methods online, where students can participate in real-world relevant tasks, increasing their intrinsic motivation to learn.

Dr. James Paul Gee, an education expert who is also an expert in game studies, underscores the importance of game elements in increasing student engagement. He stated that games offer an environment that allows players to explore, trial and error, and learn from failure without burden. These principles can be applied in education, by utilizing game elements in learning, such as competition, challenges and rewards, to increase student engagement.

Overall, education experts emphasize that student engagement is the key to achieving effective learning. Technology has an important role in facilitating student engagement by enabling personalization of learning, online collaboration, and the use of gaming elements. However, educators must also pay attention to students' psychological and motivational aspects and create an environment that supports their involvement in the learning process. (Pubian & Herpratiwi, 2022)

3. Learning outcomes

Everyone faces learning problems, because learning creates attitudes and increases knowledge. Therefore, learning outcomes are the real results of students' efforts to improve physical and spiritual skills at school. Report cards are given every semester. Evaluation must be carried out to determine the progress of a person's learning achievements. W. Winkel (Teaching Psychology book 1989:82) says that student success is the achievement achieved by students or the academic results achieved by students at school in the form of numbers. To determine the progress achieved, criteria (benchmarks) are needed that refer to the goals that have been set.

Learning outcomes are abilities that students have after experiencing learning experiences. In schools, learning outcomes are categorized into three domains: cognitive domain, affective domain, and psychomotor domain. The cognitive domain is the one most assessed by teachers because it is related to students' ability to understand lesson material. changes in student behavior after learning. Cognitive aspects, such as memorization, understanding, application, analysis, synthesis, and evaluation; affective, such as acceptance, participation, assessment, organization, and characterization; and psychomotor, such as perception, readiness, guided movements, habitual movements, complex movements, and creativity , included in these changes. The results are presented in the form of numbers or values, as shown by Sudjana (2009: 22).

For each discussion given to students, the teacher must carry out a formative test to find out whether the specific learning objectives have been achieved or not. This formative assessment shows the extent to which students have mastered specific learning objectives. This research aims to provide feedback to teachers on how to improve the teaching and learning process and

implement remedial programs for students who fail. Therefore, a learning process is considered successful only if the results meet the specific learning objectives of the material.

According to Purwanto (2011:46), learning outcomes lead to changes in behavior after learning in accordance with educational goals in the cognitive, affective and psychomotor domains. Learning outcomes in the cognitive domain include the ability to remember, understand, apply, analyze, synthesize and evaluate. In the affective domain, learning outcomes include levels of participation, evaluation, organization and characterization. The components of the psychomotor cortex are perception, preparation, guided movement, habitual movement, complex movement, and creativity

Educational technology has developed greatly compared to the past. This is definitely good for education because technology can make learning faster and more effective. We know that in the past, just getting books was very difficult; they can only depend on their teachers as a source of knowledge. However, this is different from today, where advanced technology is rapidly changing education. One example is the internet, where we can find various information by just typing.

Conclusion

Technological innovation in the digital era has resulted in significant transformation in various aspects of life, including in the world of education. This article highlights the positive impact of technological innovation on learning, with marked improvements in the accuracy of material understanding, student engagement, and learning outcomes.

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