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A Study of the Impact of Science and Technology in Education on Teaching and Learning Implementation

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Abstract: In the era of scientific and technological development, science and technology have also begun to enter the academic world, and more and more classrooms have begun to use science and technology to help teaching and learning. The impact of science and technology has received widespread attention, but the pros and cons of this still need to be discussed. This paper analyses the use of science and technology in classroom teaching. The analyses show that science and technology can break the limitations of traditional teaching and learning, which are reflected in the teacher's teaching methods, teaching techniques, and feedback. In addition, the use of technology can also enrich the classroom teaching form, expanding teaching resources. At the same time, there are many problems and challenges associated with the use of technology. Misuse of technology and low-quality technological environments pose significant challenges. Many teachers have low information awareness and poor IT skills. For this reason, this paper suggests that there is a need to examine the pros and cons of technology and to use it appropriately. On the part of teachers themselves, in-service teacher training and the promotion of information awareness or digital literacy are also needed.

Keywords: Science and Technology, AIEd, AR

1. Introduction

Technology Enabled Active Learning (TEAL) was launched in 2001 at the Massachusetts Institute of Technology (MIT), the main feature of this technology is the use of science and technology to simulate and visualize teaching and learning, which can help students to further their learning [1]. As technology continues to advance, people rely more and more on the use of computers. The UN General Assembly has stated that the Sustainable Development Goals (SDGs) call for an integrated approach to social, economic, and environmental change, with education for sustainable development (ESD) as a key component [2]. Education is one of the indicators used in the calculation of the Human Development Index (HDI), and information technology (IT) is a driving force for educational reform and a means of facilitating the sharing of knowledge in society. Many authors discuss science and technology as tools that complement traditional teaching and learning, such as the SAMR model, Artificial Intelligence (AI), the Internet, and various other technological tools. These technologies are changing the way of working and living in various fields, and schools in particular need to experience this change in education, and the implementation of teaching and learning needs to be integrated with science and technology [3].

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The theme of this paper is the positive impacts of the use of science and technology in teaching and learning, as well as the challenges and changes that teachers need to make in this regard. The significance of this study is to deepen the understanding of the use of science and technology in education, to better support future teaching and learning, and to discuss the impact of science and technology on teaching and learning to make better use of science and technology, to minimize disadvantages and make better use of the strengths of science and technology to support teaching and learning. Teachers need to help learners develop digital skills as well as educational communication skills, and the mastery of technology, pedagogy, content, and communication is based on the development of the pedagogical competence of Technology, Pedagogy, and Content of Knowledge (TPACK) [4]. This competence is also a key strategy for educational success.

2. The Application and Positive Impact of Science and Technology in Teaching and Learning

2.1. Break the Limitations of Traditional Teaching

In terms of teaching methods, Artificial Intelligence Education (AIEd) can achieve personalized teaching and change teaching methods. The feedback of learning will be analyzed with the help of AI, and teachers can get timely feedback to adjust teaching strategies, help students improve the learning experience, and provide learners with additional learning needs and knowledge content promptly. For example, AIEd predicts whether a student will fail an assessment or be withdrawn from school by modeling the results in big data, and then teachers can use the AIEd prediction results to personalize education for different students, and with the help of the technology, teachers can increase their attention to students, and the combination of the two can help students who are lagging [5].

In terms of teaching technology, previously restricted by manual teaching methods, and unable to show some of the diversity and richness of the content, AIEd can break the limitations of technology through multi-dimensional teaching methods and teaching aids.

In terms of teaching feedback, the use of science and technology in teaching can break the limitations of traditional teaching, traditional teaching teachers can not get timely feedback, in the use of science and technology can get real-time feedback. Artificial Intelligence Education (AIEd) can provide assessment to give timely feedback on teaching, traditional teaching focuses more on the teacher's unilateral knowledge output, so the feedback on teaching will be relatively weak, while AIEd can show timely feedback through data. There is a classroom communication system (CCS) that can help to improve the feedback barrier between learners and teachers. Some students are afraid of face-to-face communication and cannot communicate with each other, so the use of this system can help to overcome the limitations of the classroom, CCS allows students to anonymously raise their questions to the teacher, and the teacher will answer the questions, which is a kind of communicative teaching method. CCS allows students to anonymously ask questions to the teacher and the teacher to answer them, which is a communicative approach to teaching and learning that focuses on the student's active participation in the learning process rather than on the feedback provided by the teacher [6].

2.2. Finding Learning Styles

Firstly, the use of technology in teaching can improve learning methods and efficiency. Traditional teaching focuses on the transmission of knowledge, and students often follow the teacher's rhythm, making it difficult for them to form a learning rhythm that suits their own. But with the use of science and technology, teachers can help students find their way of learning. Artificial Intelligence (AI) shows a promising future in teaching and learning, as exemplified by OpenAI's innovation ChatGPT, which is changing the way teachers and students teach and learn in the classroom. Launched at the

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end of November 2022, this chatbot brings several benefits to education platforms. Teachers can use ChatGPT to personalize their teaching to different students, this AI tool can customize the learning methods needed for different students, which can help teachers to improve the quality of their teaching quickly, and it can also help students to improve their learning efficiency quickly [7].

Second, the use of technology also has a significant impact on student learning outcomes. For example, students can improve and learn according to the learning methods provided by ChatGPT, which helps students find their own learning pace to acquire knowledge, and students' performance can be greatly improved. ChatGPT also promotes critical thinking, and the use of ChatGPT increases students' motivation by improving their subject matter research skills, communication skills, and teamwork skills. Teachers can also focus on other more important aspects of teaching, such as student feedback or personalized education [7].

2.3. Enrichment

The use of technology can help to enrich teaching and learning by adding a variety of teaching methods. Science and technology, artificial intelligence, and so on can help reflect the new insights of science. For example, in physics courses, Augmented Reality (AR) can help learners and teachers interact with the physical world in different ways, and this technology can override the flat understanding that many learners have of physics and make it visual. AR visually presents classroom knowledge, and students can also explore their learning, which adds new ways of teaching and making learning fun [5]. There is an interactive courseware creation tool for teachers called Silver Whiteboard, which is designed for interactive teaching and learning, and can improve the teacher's experience of lesson planning. Compared with traditional teaching, the use of the XIVO Whiteboard can help teachers realize the diversified needs of teaching, in the XIVO Whiteboard, teachers can use interactive games, learning tools, and mind mapping to teach, which can provide teachers and students with an efficient learning experience, students can learn classroom knowledge while developing their imagination and creativity, teachers can also improve the quality of education in the classroom [8].

Traditional teaching methods that lack technological tools may make the entire learning process lengthy and therefore difficult to engage students. For example, a survey of lectures showed that 95 percent of ETE and CSE students felt that lectures alone did not help them to properly understand or build a knowledge structure. Learners indicated that they were unable to focus on long, boring lectures because they only provided book knowledge and did not test their knowledge or proficiency. Most of the time, learners gained information by discussing with each other, and monotonous lectures did not provide for mutual discussion. Therefore, 100% of the learners said that every course needs to introduce technology support, which can enrich the classroom mode, and students can solve some problems through IT discussion, instead of only the teacher's unilateral knowledge output in the lecture [9].

2.4. Expansion of Teaching Resources

The rapid development of modern science and technology has brought a lot of new science and technology, and education has also ushered in many new opportunities. There is a lot of artificial intelligence that can help students and teachers to get the latest knowledge and information, artificial intelligence is a supplementary tool for teaching, and teachers can use artificial intelligence to provide a lot of knowledge that is not available in the textbook to supplement the teaching. Students can also use AI to answer questions, for example, ChatGPT can quickly and accurately answer the questions asked by students, which can help them to understand and is especially helpful for students to explore different topics [10]. AIEd can also help teachers to find and share better teaching resources, for example, by using AIEd to supplement other tools Teachers pay Teachers62, then AIEd can help to

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predict the most suitable learning resources, should AIEd know the teacher's students' details, as well as the curriculum of the school or organization, which will help to filter the most suitable teaching resources [5].

The Digital Competence Framework for European Educators (DigCompEdu) views digital competence as the ability to use technology to enrich learning. Focusing on pedagogy, DigCompEdu describes the use of technology to teach different subjects in different educational settings, and teachers can assess their digital competence through the DigCompEdu self-assessment tool, which provides feedback on individual strengths and weaknesses and can help teachers to reflect on themselves [11].

3. Problems and Development Challenges

3.1. Technical and Environmental Limitations

Technology is very new and iterative, so the lack of understanding and incomplete mastery of technology will affect its use, the use of science and technology has a lot of technical and environmental limitations. For example, several external factors can affect the development and delivery of teaching and learning, such as low-quality internet access, and the fact that many people have never been exposed to the use of technology in their learning. Whalen collected data on educators' experiences using online platforms for distance learning through social media, and the results indicated that many participants reported never having engaged in distance learning before the start of COVID-19 in 2020. Many participants reported feeling overwhelmed, with statistics showing that participants faced an average of 4.89 different challenges, for example, 61% of participants felt overwhelmed by the online technology and web tools and did not know how to use them. 53% of the participants said that many of the students lacked a high-quality internet signal [12]. All of these lead to limitations in teaching with technology. Technologically, the use of some technologies can also be problematic. ChatGPT, for example, can be used to improve the quality of teaching and learning, but only if teachers can use it appropriately. Teachers need to learn not only how to use this AI, but also to understand the limitations of the tool and the ethical issues associated with it [13]. The limitations of this tool are that knowledge is limited, information is not updated in real-time, and the content of ChatGPT is not always accurate and reliable. If teachers rely on ChatGPT for content or subject information, they can easily mislead their students when they get the wrong answers, which can have a significant negative impact on students' learning and understanding of the subject matter. Ethically, the use of ChatGPT for article writing can be considered academic abuse, and academics will recognize this as dishonest in purpose [14].

3.2. Teacher Information Literacy

3.2.1. Information Awareness

The information awareness of effective teachers directly affects their ability to acquire, judge, and use information, which in turn affects the results of IT teaching. Students learning and their ability to acquire and utilize information will also be affected. Until now, many teachers, especially the old teachers, still prefer to use the traditional board book, the concept of information technology will be more inclined to gamification, and the transmission of knowledge is not so strong [15].

3.2.2. Information Competence

The use of science and technology also poses a challenge for teachers, requiring a high level of mastery of technology and the ability to organize lessons according to the technology used. In the

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development of pedagogy, pedagogy and technology as a whole, education and ICT have become the learning principles designed and applied by the educational community. In teaching and learning, ICT is the focus of educators' competencies, and teachers need to have classroom management skills using ICT [16]. Teachers need competencies in three areas: technical, pedagogical, and intellectual. In classroom management, teachers need to help learners to interact with each other and help students to improve their digital literacy skills as well as ICT-based educational communication skills. Teachers also need to give students positive and critical feedback to help them improve their learning skills. Teachers' ability to master technology, instruction, content, and communication is a factor in the development of TPACK (Technology, Instruction, Content) based pedagogical competencies, which are key to educational success [17]. The results of Whalen's study mentioned above also showed that 52% of educators lacked competence in the use of technology and knowledge of distance online teaching strategies [12].

Technology has both advantages and disadvantages and has a strong impact on the quality of teaching and learning. Technology as an efficient tool in the teaching process can also reflect the quality of teaching and learning, the use of technology as a learning medium makes the teaching and learning process more efficient, teachers can use technology to convey information to students such as learning content or materials, which can help students to strengthen their understanding of knowledge, technology makes data transmission more convenient, through the use of technology, data presentation also becomes more interesting, and the quality of teaching and learning is greatly improved. The quality of teaching and learning is greatly improved through the use of technology, which makes the transfer of data easier and the presentation of data more interesting. However, when teachers use technology incorrectly for teaching, the quality of teaching will be greatly reduced, for example, when using PowerPoint for teaching, PPT usually covers too much slide information in a short period, and it is also regarded as just a formatting of the textbook, without any additional value [18].

4. Recommendations

4.1. Technology

Technologically, the information on technology needs to be updated promptly, not only does the data need to be revised promptly, but also the content needs to be changed according to the latest policies. In addition to encompassing more information, the technology should pay more attention to the actual needs of teachers, such as the demand for cases of teaching practice, etc., and make improvements based on teachers' feedback. In addition, technology can be improved to avoid academic misconduct. If used properly, these technologies can significantly improve students' academic performance.

4.2. Teachers Themselves

Teachers themselves can make changes in three areas. Firstly, teachers need to change their way of thinking, so that their teaching and the overall development of the current era are in line with the times, they need to improve their thinking, conscious of the technology to improve, whether it is the school can go to increase the number of teacher training, teachers should take the initiative to learn some of the contents of the daily life, for example, teachers need to know some of the basics. Teachers are at the center of the use of Artificial Intelligence in Education (AIEd), and teachers need to know how to use these AI tools, the use of AI tools can also reflect the teacher's ability to teach with technology [5]. It is difficult for educators to learn if they do not understand the importance of technology as a key to successful learning, if they have low technological skills, or if they do not know how to use technological facilities. Teachers need to realize that the development and use of technology are part of human life, and in education too, technology is inextricably linked.

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Secondly, there is a need to improve teacher training so that teachers learn how to use an application or technology and understand the pros and cons of using it to avoid misuse of technology in the teaching and learning environment. In terms of future technologies, there is a need to train future technology teachers so that they can become more knowledgeable in their profession [19]. Teachers should be able to use new technologies to enrich their teaching and learning process under ethical supervision [7]. After the start of COVID-19, there is a growing awareness that educators need more training in teaching with technology, including the use of blended and online forms of technology, and many mentioned that more pre-epidemic use of technology in instructional design and more time spent using technology in the classroom could help diversify instruction for students and better articulate the coherence of distance learning, which could alleviate the need for teachers to use new technologies to enrich their teaching processes [7]. It also reduces the pressure on teachers to use technology for teaching and learning. Regarding teacher training, teachers need to participate in learner-centered activities such as self-directed learning, working with other tutors, and practicing the use of technology on an ongoing basis, which are the most effective ways to help teachers adapt their learning strategies [12].

Thirdly, teachers can be upgraded and providers of in-service teacher training and support can create an unstructured professional development (mentoring online forum), which is a learner-centered activity, where educators can develop their knowledge and skills to help them use technology to teach in any situation [20]. Educational systems need the flexibility to use real-time systems for analytics, and AIEd is a good aid to this, as the AIEd system can help educators get real-time analytics to further develop new skills and competencies. Educators need to understand the basics of AIEd, the pros and cons of AIEd, and then unleash the wisdom of AIEd and make changes to the pedagogy of keen observation [5].

5. Conclusion

This paper argues that bringing science and technology into classroom teaching can bring many benefits, science and technology break the limitations of traditional teaching, help more students find their way of learning, and learn to think critically, the teacher's classroom teaching form has become richer, students and teachers can use science and technology to get a lot of teaching materials outside the classroom. At the same time, the use of technology in the classroom poses many challenges, and the use of technology in the classroom can have a significant impact on the environment and the negative use of technology. Teachers' ability to use technology also poses problems, and the use of technology can affect the quality of teaching and learning. In this regard, teachers need to increase their knowledge of the use of different technologies and receive teacher training in technology to improve their beliefs in digital competence. This study will help more teachers to better understand the use of technology and to use it appropriately in the classroom. In the future, the development of science and technology will enrich classroom teaching and learning.

References

[1] *Shieh, R. S. (2012). The Impact of Technology-Enabled Active Learning (TEAL) Implementation on Student Learning and Teachers' Teaching in a High School Context. Computers & Education, 59(2), 206-214.*
[2] *Assembly, U. G. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development, 16301.*
[3] *Burbules, N. C., Fan, G., & Repp, P. (2020). Five Trends of Education and Technology in a Sustainable Future. Geography and Sustainability, 1(2), 93-97.*
[4] *Rosenberg, J. M., & Koehler, M. J. (2015). Context and Technological Pedagogical Content Knowledge (TPACK): A Systematic Review. Journal of Research on Technology in Education, 47(3), 186-210.*
[5] *Luckin, R., & Holmes, W. (2016). Intelligence Unleashed: An Argument for AI in Education.*
[6] *Caldwell, J. E. (2007). Clickers in the Large Classroom: Current Research and Best-Practice Tips. CBE--Life Sciences Education, 6(1), 9-20.*

DOI: 10.54254/2753-7048/84/2025.20768

[7] *Montenegro-Rueda, M., Fernández-Cerero, J., Fernández-Batanero, J. M., & López-Meneses, E. (2023). Impact of the Implementation of ChatGPT in Education: A Systematic Review. Computers, 12(8), 153.*

[8] *Huang, J. (2024). Rational Use of Xiwo Whiteboard to Build a Junior High School Mathematics Wisdom Classroom. Education (19), 29-31.*

[9] *Mili, S., & Rezwan, T. M. A. (2006). Strengths and Limitations of Different Teaching Modes:: A Comparative Study. DIU Journal of Business and Entrepreneurship, 1(1), 144-157.*

[10] *Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the Opportunities Through Chatgpt Tool Towards Ameliorating the Education System. BenchCouncil Transactions on Benchmarks, Standards and Evaluations, 3(2), 100115.*

[11] *Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can Teachers' Digital Competence Influence Technology Acceptance in Vocational Education? Computers in Human Behavior, 132, 107266.*

[12] *Whalen, J. (2020). Should Teachers be Trained in Emergency Remote Teaching? Lessons Learned from the COVID-19 Pandemic. Journal of Technology and Teacher Education, 28(2), 189-199.*

[13] *García-Peñalvo, F. J. (2023). La Percepción de la Inteligencia Artificial en Contextos Educativos Tras el Lanzamiento De Chatgpt: Disrupción o Pánico. Education in the Knowledge Society (EKS), 24, e31279-e31279.*

[14] *Rahman, M. M., & Watanobe, Y. (2023). ChatGPT for Education and Research: Opportunities, Threats, and Strategies. Applied Sciences, 13(9), 5783.*

[15] *Xu, J. (2020). Research on the Evaluation Model and Application of University Teachers' Information Awareness in the Information Age. In IOP Conference Series: Materials Science and Engineering. 768(5), 052136.*

[16] *Mama, M., & Hennessy, S. (2013). Developing a Typology of Teacher Beliefs and Practices Concerning Classroom Use of ICT. Computers & Education, 68, 380-387.*

[17] *Koh, J. H. L., & Chai, C. S. (2016). Seven Design Frames that Teachers Use When Considering Technological Pedagogical Content Knowledge (TPACK). Computers & Education, 102, 244-257.*

[18] *Seth, V., Upadhyaya, P., Ahmad, M., & Moghe, V. (2010). PowerPoint or Chalk and Talk: Perceptions of Medical Students Versus Dental Students in a Medical College in India. Advances in Medical Education and Practice, 11-16.*

[19] *Bahodirovich, O. J., & Romilovich, B. R. (2021). Project for Training Professional Skills for Future Teachers of Technological Education. Mental Enlightenment Scientific-Methodological Journal, 139-150.*

[20] *Zweig, J., & Stafford, E. (2016). Training for Online Teachers to Support Student Success: Themes from a Survey Administered to Teachers in Four Online Learning Programs. Journal of Online Learning Research, 2(4), 399-418.*