

The Role of Integrating Artificial Intelligence and Virtual Simulation Technologies in Physics Teaching

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Abstract. With the continuous progress of information technology, the integration of artificial intelligence and virtual simulation technologies into the teaching system is of great significance to promote the informatization reform of physics teaching and the cultivation of innovative talents. This paper first introduces the characteristics of the combination of artificial intelligence and virtual simulation technologies, then comprehensively analyzes the positive effects of the integration of artificial intelligence and virtual simulation technologies on physics teaching, and finally puts forward some thoughts and suggestions on the integration of artificial intelligence and virtual simulation technology into physics teaching.

Keywords: Artificial intelligence; virtual simulation; physics teaching.

1. Introduction

Physics, as a basic subject, plays an important role in the progress of science and technology and the development of human society. Physics education not only aims to cultivate students to master physical theoretical knowledge and apply physical knowledge to solve practical problems, but also focuses on cultivating the innovative thinking and scientific world outlook of students. However, for a long time, traditional physics teaching is mainly based on classroom teaching by teachers and students listening to lectures, supplemented by experimental teaching. There are some problems such as boring classroom, monotonous experiments and passive learning in traditional physics teaching, and there is also a problem that physics courses are not closely related to other disciplines in traditional physics teaching. The existence of these problems limits the personal development and comprehensive ability and quality training of college students.

With the rapid development of modern science and technology, physics educators are constantly trying and exploring teaching methods and tools that integrate emerging technologies. In recent years, virtual simulation teaching has brought new vitality to the field of physics education [1-3]. By presenting the important and difficult contents of physics teaching with virtual simulation technology, more rich and realistic physics scenes can be created for students. In this learning mode which does not depend on teachers, students will be able to lead the learning process according to their own situation and improve their learning effectiveness and abilities through active participation, experience and exploration. As an innovative teaching mode integrating modern science and technology, virtual simulation teaching is gradually receiving more and more attention from physics teaching workers and students.

Virtual simulation teaching is a new teaching method, which is the product of combining virtual reality, simulation technology with education and teaching. As a typical example of "Internet plus" education and teaching in the new era, it uses virtual reality and simulation technology to upgrade traditional education and teaching resources and promote the informatization reform process of higher education. Especially in recent years, the rapid development of artificial intelligence technology has brought more possibilities for the combination of virtual simulation technology and physics teaching [4-6]. The combination of virtual simulation technology and artificial intelligence technology enables teachers to carry out information and intelligent teaching in virtual environment. The integration of artificial intelligence and virtual simulation technologies has brought new opportunities and challenges to physics teaching.

2. Features of integrating artificial intelligence and virtual simulation technologies

The combination of artificial intelligence and virtual simulation technologies has made virtual simulation teaching change from desktop style to immersion style. Virtual simulation technology based on artificial intelligence is a technology that uses advanced sensing technology, powerful algorithms and big data processing capabilities to simulate realistic real environment and scenarios. On the one hand, through the combination of artificial intelligence and virtual simulation technologies, the traditional teaching content is presented in an immersive intelligent interactive display system, which makes the presentation mode of traditional teaching content upgraded, more intuitive and vivid, enhances students' enthusiasm for autonomous learning and improves teaching effectiveness [7]. On the other hand, by simulating various situations, students can experience various real physical situations in the virtual world. Through immersive and interactive virtual experiences, stimulation and feelings can be strengthened, which can deepen their understanding and mastery of physical concepts and laws.

The combination of virtual simulation technology and artificial intelligence has broken through the education and teaching mode limited by time and space, and promoted the rational optimization and efficient use of education and teaching resources. Limited time and space factors, traditional theoretical teaching and experimental teaching are separated, usually lack close contact, and cannot complement each other in time, thus failing to improve the learning effect. Integrating artificial intelligence with virtual simulation technology closely connects the theoretical contents and practical contents of traditional teaching, presents theoretical knowledge in an immersive and interactive way, and allows students to practice in a realistic virtual environment. Students can deepen their understanding of theoretical knowledge by applying theoretical knowledge to solve practical problems.

3. The role of integrating artificial intelligence and virtual simulation technologies in physics teaching

The integration of artificial intelligence and virtual simulation technologies into physics teaching provides a broader space for physics teaching. It is helpful to promote the transformation of physics teaching to the innovative mode of intelligent interaction, independent exploration, and team collaborative learning. Through breaking the time and space limitation of traditional teaching, teaching effectiveness can be effectively improved, and the reform of physics teaching informatization and innovative talent cultivation mode can be further promoted. The integration of artificial intelligence and virtual simulation technologies plays a positive role in physics teaching in many aspects.

3.1 The integration of artificial intelligence and virtual simulation technologies in physics teaching can promote students to systematically learn physics knowledge

Physics is the foundation of natural science. The learning process of physics can not be separated from the formation of physical concepts, the summary of physical laws, the construction of physical models and the training of physical thinking. The integration of artificial intelligence and virtual simulation teaching can effectively realize the systematic learning of physical knowledge through immersive, interactive and exploratory learning experiences. Physical contexts are very important for the understanding and application of physical concepts and laws. With the help of artificial intelligence and virtual simulation technologies, physical contexts that are difficult to implement or abstract in physics teaching contents can be vividly and intuitively simulated and reproduced, promoting and intensifying the understanding of students to physical knowledges. In physics teaching, the establishment of physical images is also of great benefit to learning. Many physical knowledges are obscure and abstract formulas. With the help of artificial intelligence and virtual

simulation technologies, abstract problems can be concretized, and physical formulas can be visualized and contextualized, thus it will be beneficial for students to master and apply knowledges skillfully. For example, in physics teaching, electric field and magnetic field are more abstract than other physical research objects. Using artificial intelligence and virtual simulation technologies to simulate real electric field and magnetic field could create various physical scenarios for the generation and changes of electric and magnetic fields, intensifying the understanding of relevant concepts and laws for students. For another example, in atomic physics, it is difficult to visually imagine the movement and interaction of microparticles. However, with the help of artificial intelligence and virtual simulation technologies, not only can atomic models be reproduced, but physical situations can also be designed. As a result, students can experience the process of constructing and proposing atomic nuclear models along the footsteps of Rutherford and others, thereby improving their ability to build physical models and to solve practical physical problems.

3.2 The integration of artificial intelligence and virtual simulation technologies in physics teaching is beneficial to cultivate the independent innovation ability of students

Physics is a subject based on experiments, which is a fundamental course that science and engineering students must learn after entering universities. It aims to cultivate the ability of students in observing phenomena, posing questions, consulting materials, proposing hypotheses, determining plans, and conducting experimental verification, etc. It promotes students to cultivate scientific thinking and consciousness, and enhance their abilities to innovate independently. With the rapid development of economy, the continuous progress of science and technology, and the continuous renewal of knowledge structure, physics teaching is constantly innovating and exploring teaching modes. The integration of artificial intelligence and virtual simulation technologies is helpful to promote the process of reforming the training mode of innovative talents in physics teaching.

Integrating artificial intelligence and virtual simulation technology into physics teaching is an innovative teaching mode. By providing diverse physical contexts and rich experimental equipment through simulation, an excellent experimental platform is provided for students to explore physical problems independently. Considering the different degrees of learning ability and understanding ability of each student, using artificial intelligence technology can integrate the big data of students' autonomous learning process, providing diverse suggestions and choices for students to carry out autonomous exploratory experiment design. In addition, the integration of artificial intelligence and virtual simulation technologies can provide an interactive learning environment for physics teaching, which is a good platform for students to cultivate innovative consciousness, innovative thinking, and innovative ability. Students can choose challenging research problems independently according to their own learning abilities and interests. Through experimental exploration and data analysis, they can cultivate problem-solving ability and innovative thinking, and stimulate their learning interest and initiative. In addition, the integration of artificial intelligence and virtual simulation technologies can provide auxiliary learning resources and learning guidance according to the personalized situation of each student, helping them better understand physical knowledge and improve their experimental abilities. This physics teaching mode with autonomy, openness and flexibility is more conducive to cultivating the innovative thinking and innovative ability of students.

3.3 The integration of artificial intelligence and virtual simulation technologies in physics teaching can fully realize the optimal utilization of resources

Due to the limitation of time, space and resources, traditional physical theory teaching and experiment teaching are separated. Especially with the rapid development of modern physics, the related experimental teaching is more difficult. The related experimental instruments and equipment are very expensive and require a lot of space. Besides, some instruments and equipment have high risk factors, which greatly limits the combination of experimental teaching and theoretical teaching. The integration of artificial intelligence and virtual simulation technologies can break through the

limitations of time and space, and can be carried out anytime and anywhere. Not only can multiple physical experiments be conducted simultaneously, but also independent exploratory experiments can be conducted, fully filling the limitations of insufficient experimental teaching resources and providing better experimental resources and greater space for physics teaching.

The integration of artificial intelligence and virtual simulation technologies can not only provide reusable experimental resources, but also timely upgrade and transform experimental resources based on feedback of learning process from students. Students can also deepen their understanding of physical principles and laws in experiments by repeating related experiments multiple times, without worrying about the occupation and waste of experimental resources. In addition, the integration of artificial intelligence and virtual simulation technologies into physics teaching makes the physics teaching process open, autonomous, and interactive. Universities can open and share teaching and learning resources, fully developing their resource advantages.

3.4 The integration of artificial intelligence and virtual simulation technologies in physics teaching can promote interdisciplinary integration

The problems encountered in the development of modern science and technology are usually no longer the problems of a single discipline, but often need to be solved by comprehensively applying interdisciplinary knowledge and skills. However, traditional physics teaching focuses on imparting basic knowledge, which is limited by the teaching environment, lacks practical links, and is not closely integrated with other disciplines. Through artificial intelligence and virtual simulation technologies, knowledge theories and skill methods from different disciplines can be integrated, which can encourage students to explore problems interdisciplinary in experiments and cultivate their comprehensive abilities. Through the combination of virtual simulation technology and artificial intelligence technology, students can simulate and experience complex problem situations, explore interdisciplinary knowledge and skills through problem guidance, and form the habit of innovative thinking. In addition, integrating artificial intelligence and virtual simulation technologies can also bring students from different disciplines together in a virtual environment. Students can cooperate and communicate in teams across disciplines, share ideas and discuss problems in real time, solve problems and complete tasks together. This kind of cooperation that transcends time and space constraints promotes interdisciplinary cooperation and communication, and can promote the formation of innovative thinking ability. This experience of interdisciplinary cooperation helps students develop the ability to cope with complex problems and work environments.

4. Summary

The integration of artificial intelligence and virtual simulation technologies in physics teaching can contextualize physical problems and visualize physical thinking, fully exciting the enthusiasm of students for independent learning and exploration and making physics teaching simple and efficient. According to the characteristics of physics discipline, integrating artificial intelligence and virtual simulation into physics teaching can promote the reform of physics teaching, and there is still great space for development and progress in the future.

1) With the development of artificial intelligence and virtual simulation technologies, the application of artificial intelligence and virtual simulation technologies in physics teaching will be widened continuously

With the continuous progress of computer technology, virtual reality technology and artificial intelligence technology, the integration of artificial intelligence and virtual simulation technologies will make physics teaching more interactive, provide students with more immersive learning experience, and further promote the interdisciplinary integration and the cultivation of innovative thinking. These positive impacts will further promote the widespread application of artificial intelligence and virtual simulation technologies in physics teaching, which in turn will promote the

development and iteration of related technologies, forming a virtuous circle in which technology development and teaching application promote each other.

2) Integrating artificial intelligence and virtual simulation into physics teaching provides a channel for promoting the construction of curriculum evaluation systems

In teaching feedback and evaluation, through integrating artificial intelligence and virtual simulation technologies, teachers can not only use big data analysis to quickly know the specific learning and mastery situation of each student, but also scientifically and reasonably evaluate the learning weaknesses of their students, providing data support for subsequent targeted teaching. By integrating artificial intelligence and virtual simulation technologies, personalized adjustments can be made and customized learning strategies can be provided in physics teaching based on the feedback of learning situations and needs from the students. Through intelligent analysis and evaluation of learning process, students can also have a clearer understanding of their learning progress and shortcomings, so as to make targeted improvement. This intelligent teaching feedback and evaluation provides channels and support for effectively promoting the construction of curriculum evaluation system.

3) The integration of artificial intelligence and virtual simulation into physics teaching provides a foundation for the integration of industry and education in future physics courses

As a fundamental discipline, physics teaching still has great room for improvement in the integration of industry and education. In order to improve the engineering practical abilities of students through physics teaching in colleges, it is necessary to carry out comprehensive and scientific design and make great efforts to build an environment conducive to the integration of industry and education in physics teaching. The integration of artificial intelligence and virtual simulation technologies into physics teaching can not only strengthen the connection between disciplines, promote interdisciplinary communication and cooperation, but also improve the abilities to apply theoretical knowledge to solve practical problems by the supplementation of practical links. This experiential foundation of learning to solve practical problems is conducive to designing examination questions according to the actual needs of enterprises, and students can freely form teams and work together to improve their teamwork abilities and comprehensive abilities to solve practical problems. This teaching mode will lay a solid foundation for the integration of industry and education in future physics teaching.

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