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Research on Teaching Reform of Engineering Drawing Courses in Application-oriented Universities—Take Wuzhou University as an Example

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Abstract: With the rapid development of artificial intelligence technology and its deep integration into engineering drawing, teaching engineering drawing courses in application-oriented universities faces the demand for reform. Guided by market demand, Wuzhou University, as an application-oriented undergraduate university, strengthens the combination of theory and practice by introducing mixed online and offline teaching modes, project-driven methods, and case teaching. For example, students' innovative thinking and practical abilities are stimulated by relying on the wisdom tree platform to implement modular teaching and combine it with real engineering cases. Students' professional adaptability is improved by deepening school-enterprise cooperation and inviting industry experts to participate in teaching. The application value of constructivism and blended learning theory is emphasized, and the student-centeredness is advocated. The knowledge system is constructed through independent inquiry and collaborative learning. The teaching environment is optimized by integrating virtual and augmented reality and other technologies. The teaching reform practice shows that integrating artificial intelligence technology can improve students' drawing skills, innovation consciousness, and ability to solve practical engineering problems and guarantee training high-quality talent in line with industrial needs. In the future, multiple methods, such as project-based learning and flipped classrooms, need further exploration. It can promote the deep integration of engineering drawing technology and cutting-edge technology and help application-oriented universities achieve efficient docking of educational goals and social needs.

1. Introduction

Artificial intelligence technology has become an important force leading the digital transformation [1-3], and its application in engineering drawing is also increasingly widespread. With the help of advanced machine learning algorithms and deep learning technologies, artificial intelligence can assist designers in efficient and accurate drawing and realize functions such as automatic drawing and

intelligent recognition, significantly improving drawing efficiency and accuracy.

By training a large number of engineering drawing data, the artificial intelligence system can learn the inherent laws and characteristics of the drawings and automatically classify, identify, and analyze the new engineering drawings. This intelligent processing method reduces the time and cost of manual review and improves mapping standardization and consistency. Artificial intelligence can combine with traditional CAD software to achieve more intelligent auxiliary design functions, such as automatically optimizing design schemes and providing innovative design ideas.

In application-oriented universities such as Wuzhou University, the teaching of engineering drawing courses has begun to integrate artificial intelligence technology. By introducing intelligent teaching tools and platforms, teachers can teach and guide more efficiently, and students can more intuitively understand and master the knowledge and skills of engineering drawing.

With the continuous progress of deep learning, computer vision, and other technologies [4-6], the application of artificial intelligence in engineering drawing will be more in-depth and extensive. On the one hand, artificial intelligence will be able to more accurately understand complex information and subtle differences in engineering drawings and achieve more refined auxiliary design and drawing functions. On the other hand, artificial intelligence will combine with cutting-edge technologies such as virtual and augmented reality to provide designers with a more immersive mapping environment and interactive experience.

With the popularization and deepening of professional accreditation in engineering education, teaching engineering drawing courses will be more practical and innovative. Introducing artificial intelligence technology will help to enhance students' practical abilities and innovative awareness and cultivate more engineering talent with international competitiveness. With the continuous development of big data technology, the data resources in engineering drawing will be more prosperous and diverse, providing a broader space and possibilities for the application of artificial intelligence.

The application of artificial intelligence technology in engineering drawing is in a rapid development stage and is expected to bring revolutionary changes and innovations to this field. For application-oriented universities, following the development trend of artificial intelligence technology and strengthening the teaching reform and innovative practice of engineering drawing courses will help to improve the quality of talent training and professional competitiveness.

2. Social needs and talent training

Currently, the demand for engineering drawing talent is increasing, which is closely related to Chinese macro strategy and industrial development. Especially with the in-depth implementation of national strategies such as 'Made in China 2025', the manufacturing industry's transformation and upgrading have put higher requirements for high-quality talent with engineering drawing skills. The demand for such talent is particularly urgent in key areas such as high-end equipment manufacturing and aerospace. They need to have a solid basic knowledge of engineering drawing and be proficient in AutoCAD, SolidWorks, and other drawing software and tools to quickly and accurately draw engineering drawings that meet industry standards.

Facing such social needs, application-oriented universities, as the cradle of engineering and technical talent, have a great responsibility. Such universities must focus highly on the teaching quality and effect of engineering drawing courses because they play an irreplaceable role in realizing their training objectives. In the teaching process, universities should pay attention to cultivating students' practical abilities and innovative thinking so that they can solve practical engineering problems. The integration of theory and practice is indispensable for engineering drawing courses. By strengthening the practical teaching links, such as introducing actual engineering cases and

carrying out project-based teaching, students' hands-on abilities and practical skills can be effectively improved to better meet social needs [7].

The teaching reform of engineering drawing courses is constantly explored. Studies show that using the target decomposition method, the primary teaching contents of the engineering drawing courses can be delicately analyzed, decomposed, and integrated to clarify the main line of the courses and the teaching objectives at all levels. This method helps establish a performance evaluation system for students' multi-perspective and cooperative learning. It can continuously improve the teaching quality of drawing courses in research and practice and comprehensively promote the development of students' literacy and drawing abilities [8].

Close collaboration with industry is also an important way to improve the quality of engineering drawing instruction. Universities can invite engineers with rich practical experience to participate in teaching. Students can more intuitively understand how engineering drawing is applied in practical work through their statements and practical guidance. This teaching mode of school-enterprise cooperation can enable students to apply what they have learned and lay a solid foundation for their future careers.

Facing the urgent social need for engineering drawing talent, application-oriented universities should constantly adjust and optimize their engineering drawing courses' teaching systems and methods to cultivate more high-quality talent that meets industrial development needs [9].

3. Background and significance of teaching reform

With the rapid development of science and technology, artificial intelligence technology is increasingly integrated into all walks of life, and the field of engineering drawing is no exception. The application of artificial intelligence technology in aided design, automatic drawing, and intelligent recognition has significantly improved drawing efficiency and accuracy, bringing revolutionary changes to engineering drawing. The social demand for talent with high-quality engineering drawing skills continues to grow. The demand for such talent is particularly urgent in key areas such as high-end equipment manufacturing and aerospace. These industries expect talent to be able to master the basis of engineering drawing and to use various drawing tools and software to quickly and accurately draw engineering drawings that meet professional requirements.

In this context, the teaching quality of engineering drawing courses in application-oriented universities is paramount as the basis for training engineering and technical talent. Traditional teaching methods have been difficult to adapt to the current social demand for talent, so comprehensive and in-depth teaching reform is urgently needed [10].

The core purpose of teaching reform is to improve the quality and effect of teaching to cultivate high-quality engineering and technical talent in line with social needs. The reform can help students master the knowledge and skills of engineering drawing more efficiently and improve their practical abilities and innovative spirit. In addition, teaching reform can promote the development and innovation of disciplines, promote the deep integration of engineering drawing technology and advanced technologies such as artificial intelligence, and contribute to the industry's progress.

In order to achieve this goal, many universities have begun to explore the online and offline mixed teaching modes and analyze their application characteristics with specific examples. For example, based on the innovative tree platform, a new exploration of the online and offline mixed teaching modes of engineering drawing courses is carried out to make students master the course knowledge more efficiently and firmly. Modular teaching is implemented to stimulate students' learning interests and internal needs and improve their learning effect and practical abilities through teaching methods such as combination creation and task-driven methods.

Application-oriented universities have urgent needs in the teaching reform of engineering drawing

courses, and it is of great significance to carry out comprehensive and in-depth teaching reform. It can improve the quality and effectiveness of teaching, cultivate more high-quality engineering and technical talent that meet social needs, promote the disciplines' development and innovation, and promote the integration and application of advanced technologies such as engineering drawing and artificial intelligence. Therefore, application-oriented universities should actively respond to the times' call and vigorously promote the teaching reform of engineering drawing courses.

Engineering drawing courses play an important role in application-oriented universities. They are the introductory engineering and technical talent training courses and the bridge between theory and practice. In the current teaching practice, finding a series of problems to solve in engineering drawing courses is not difficult.

Although engineering drawing courses have been widely opened in application-oriented universities, the teaching content and methods are often outdated and fail to keep up with the pace of the times. Many universities still use traditional teaching materials and methods in engineering drawing teaching, leading to a profound disconnection between the course content and the demand for new technologies and methods in today's society.

In addition, based on teachers' teaching and supplemented by students' practice, the teaching methods are also too single. This model makes it difficult to stimulate students' interests and learning initiative and is not conducive to cultivating their innovative thinking and practical abilities.

4. The educational concept of application-oriented universities

The educational concept of application-oriented universities profoundly reflects modern higher education's practicability and market orientation. Guided by market demand, such universities pay attention to theoretical knowledge teaching and emphasize cultivating students' ability to transform theoretical knowledge into practical operation and an innovative spirit. The formation of this concept is not only a reflection on the traditional higher education model but also a positive response to the current social development trend.

The educational concept of application-oriented universities has been fully reflected in the engineering drawing courses. As an essential skill in engineering technology, engineering drawing is self-evident in its practicality and applicability. Therefore, in the teaching process of universities, the combination of theoretical knowledge and practical operation is emphasized. By introducing case teaching, project-driven, and other teaching methods, students can deepen their understanding of theoretical knowledge in practical operations and cultivate their ability to solve problems.

Applying the case teaching method enables students to be exposed to the actual engineering environment to improve their practical abilities and innovative thinking by analyzing and solving specific problems. The project-driven method goes further. It requires students to accomplish a complete project independently under the guidance of teachers to exercise their engineering design, drawing, and teamwork abilities fully. The practical implementation of these methods depends on teachers' professional quality and teaching experience and requires universities to provide sufficient practical teaching resources and a good learning environment.

Application-oriented universities also focus on cultivating students' professional quality and comprehensive abilities. In engineering drawing courses, this is manifested in the emphasis on students' rigorous work attitude, good communication skills, and continuous learning ability. Through these efforts, universities expect to cultivate excellent talent with solid professional skills and sound professional qualities to meet the social needs for high-quality engineering and technical talent.

The educational concept of application-oriented universities has been fully implemented in the engineering drawing courses. This education concept is oriented by market demand and pays attention to cultivating practical abilities and an innovative spirit. It improves the quality of teaching and lays

a solid foundation for students' development. It also strongly supports the close connection between universities and society and the development and innovation of sustainable disciplines.

On this basis, application-oriented universities should continue to deepen teaching reform and constantly optimize the curriculum and teaching methods to meet the needs of social development and technological progress. For example, more advanced engineering drawing technology and software can be introduced to strengthen students' information literacy and technical application abilities. School-enterprise cooperation and practical training enhance students' professional adaptability and market competitiveness. These measures will further help realize the educational concept of application-oriented universities and cultivate more high-quality engineering and technical talent that meet social needs.

In the theory of teaching reform, constructivist learning theory and mixed learning theory occupy important positions. Constructivist learning theory advocates that learning is an active and constructive process, emphasizing that students construct their knowledge and understanding through interaction with the environment. From this theoretical perspective, students are no longer passive knowledge recipients but become active knowledge constructors. In engineering drawing courses, students need to actively explore and construct the knowledge system of engineering drawing through practical operation, problem-solving, and teamwork.

Mixed learning theory combines the advantages of traditional classroom and digital learning, aiming to provide more flexible and diversified learning methods both online and offline.

In the teaching process of engineering drawing, mixed learning can be expressed as previewing, reviewing, and self-testing using online resources, focusing on explanation, practical operation, and group discussion in the classroom. This mixed mode improves learning flexibility and autonomy and helps cultivate students' autonomous learning ability.

5. Conclusions

In teaching reform practice, constructivist learning theory and mixed learning theory provide new ideas and methods for teaching engineering drawing courses. Guided by constructivist learning theory, teachers can design a series of practical engineering cases for students to discuss and study in groups. For example, when teaching part drawing, practical mechanical parts can be introduced as cases so that students can deepen their understanding of part drawing methods and specifications by observing, measuring, and drawing.

Applying mixed learning theory also makes teaching methods more diversified and flexible. Teachers can use the online platform to publish preview materials and self-study tasks to guide students to learn and explore independently. Teachers can focus on explaining difficulties and doubts in the classroom and organize students to conduct practical operations and display results. For example, when drawing three views of the combination, teachers can publish the three-dimensional model and related materials through the online platform so that students can preview and self-study before class. In the classroom, the teacher focuses on the drawing methods and precautions of the three views of the combination and guides students to carry out practical operations and group discussions.

Applying teaching reform theory in engineering drawing courses improves the teaching effect and learning experience and helps cultivate students' practical abilities and innovative spirit. By using advanced teaching concepts and methods such as constructivist learning theory and mixed learning theory, application-oriented universities can better meet the social needs for high-quality engineering and technical talent.

These teaching reform theories can also be combined with other advanced teaching methods, such as project-based learning and flipped classrooms, to improve engineering drawing courses' teaching

quality and effect. For example, in project-based learning, students can independently select or design project tasks related to engineering drawing under teachers' guidance. They can comprehensively improve their engineering drawing abilities and comprehensive quality through practical operation, teamwork, and achievement display. This project-driven teaching method can stimulate students' learning interests and motivation and cultivate their problem-solving ability and teamwork spirit.

Applying teaching reform theory in engineering drawing courses has broad prospects and important practical significance. Application-oriented universities should actively explore and practice these advanced teaching concepts and methods to contribute to cultivating more high-quality engineering and technical talent that meets social needs.

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