

Research on the Teaching Reform of Engineering Drawing Courses in Application-oriented Universities Driven by AI Empowerment and Industry-Education Integration

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Abstract: With the rapid development of artificial intelligence (AI) technology and the upgrading of industrial intelligence, the engineering drawing courses in application-oriented universities face outstanding problems such as the disconnection between theoretical teaching and practical application, the lack of students' innovative ability and the teaching content lagging behind the needs of industry. Based on the core reform concept of "AI empowerment and industry-education integration," the teaching innovation path of engineering drawing courses is systematically discussed. The curriculum system is reconstructed by introducing AI technology (such as three-dimensional modeling software and VR/AR virtual simulation platform), the proportion of theoretical and practical teaching is optimized, and students' spatial imagination and mapping skills are strengthened. By deepening the cooperation between schools and enterprises and taking project-based learning and industry case training as the carrier, the precise docking of teaching content with the needs of cutting-edge fields such as intelligent manufacturing and smart cities is promoted. The teaching practice shows that AI technology can significantly improve students' innovative thinking and complex engineering problem-solving abilities. The industry-education integration mechanism effectively shortens the gap between talent training and industrial demand and realizes the dynamic updating of curriculum content and the collaborative cultivation of professional quality. The reform model proposed in this paper provides a practical paradigm for engineering drawing courses in application-oriented universities and has important reference value for promoting the digital transformation of engineering technology education and serving regional industrial upgrading.

Keywords: Application-oriented universities. Engineering drawing courses. AI empowerment. Industry-education integration. Teaching reform.

1. Introduction

In the field of application, AI is helping to upgrade intelligent manufacturing. By introducing intelligent robots and automation equipment, the efficiency and accuracy of the production line have been significantly improved. AI is key in constructing smart cities^[1-3]. For example, urban managers can allocate resources more efficiently and optimize urban traffic conditions through big data analysis and intelligent transportation systems.

AI applications in intelligent medical treatment are increasingly widespread. From assisting diagnosis and intelligent surgical robots to patient health management, the introduction of AI technology improves the efficiency of medical services. It brings more accurate and personalized treatment options for patients.

The development direction of AI technology is diversified and in-depth, and it has shown great application potential in various fields. With the continuous advancement of technology and the continuous expansion of application scenarios, there is a reason to believe that AI will play a more important role in the future society^[4-6].

The rapid development of AI technology poses new challenges and opportunities for higher education. Especially in application-oriented universities, how to combine the latest development trend of AI technology to carry out curriculum teaching reform and cultivate high-quality talent in line with

social needs has become an urgent problem.

For example, traditional teaching content and methods have been difficult to adapt to the needs of modern engineering technology in engineering drawing courses. Therefore, it is necessary to integrate the related technologies and concepts of AI into the curriculum teaching to improve students' practical ability and innovative thinking.

2. Teaching Methods and Ways

While implementing these teaching reforms, some problems need to be addressed. The continuity and stability of teaching reform are ensured to avoid frequent reforms and changes to prevent affecting students' learning effect and enthusiasm. It is necessary to consider students' actual situation fully and needs and formulate personalized teaching programs and counseling programs to meet different students' learning needs and development goals. The contact and cooperation with enterprises and industries are strengthened to keep abreast of industry trends and talent needs to adjust the teaching content and methods and better cultivate students' practical ability and professional quality^[7-8].

Through these comprehensive teaching reform measures, the teaching quality and effect of engineering drawing courses are effectively improved, more professional talent with a solid engineering drawing foundation and good innovation ability is cultivated, and positive contributions are made to promoting innovation and development in the field of

engineering technology^[9-10].

3. Students' Abilities and Needs

The current situation of students' ability in engineering drawing courses is not optimistic, and there is a significant gap in the social demand for engineering drawing talent. This gap is mainly reflected in two aspects: students' spatial imagination and drawing skills are generally weak, and students lack innovative thinking and the ability to solve practical problems.

Regarding spatial imagination ability and drawing skills, many students find it challenging to meet the requirements of high-precision and high-efficiency drawing talent in engineering technology. Traditional engineering drawing teaching pays too much attention to theory teaching and ignores the importance of practical operation. It leads to insufficient practical opportunities for students to exercise and improve their drawing skills. In addition, some students have deficiencies in visual-spatial relations, which may be related to the lack of relevant training and guidance in the previous education stage.

To improve students' spatial imagination and drawing skills, teachers can consider introducing more practical links, such as organizing students to carry out practical engineering drawing operations or using modern teaching methods like three-dimensional modeling software to assist teaching. These measures help students understand and master the knowledge and skills of engineering drawing in practice and improve their spatial imagination and drawing level.

The lack of students' innovative thinking and ability to solve practical problems is also an urgent problem that needs to be solved. In traditional teaching of engineering drawing, students only passively accept knowledge and lack the opportunity to think and explore actively. This teaching method is not conducive to cultivating students' innovative thinking and ability to solve practical problems.

To cultivate students' innovative thinking, teachers can adopt problem-oriented teaching methods to guide students to think and explore problems actively in engineering drawing. Teachers can also encourage students to participate in extracurricular scientific research projects or practical activities and exercise students' innovative thinking and ability to solve practical problems through practice.

A significant gap exists between students' ability in engineering drawing courses and social needs. It is mainly reflected in spatial imagination ability, drawing skills, innovative thinking, and ability to solve practical problems. To narrow this gap, teachers must actively explore new teaching methods and means and focus on cultivating practical teaching and innovative thinking to improve students' engineering drawing ability and meet the social needs for engineering drawing talent.

Facing the industry's high standard demand for engineering drawing talent, higher education institutions should actively adjust teaching strategies to cultivate students' practical operation ability and innovative thinking. For example, by introducing project-based learning, students can master engineering drawing skills in practical operations and develop their teamwork and problem-solving skills. It can enhance students' employment competitiveness and help them better adapt and contribute to engineering technology development in their future careers.

Educational institutions should maintain close contact with the industry and keep abreast of the latest developments and changes in talent demand. By cooperating with enterprises to carry out practical training and co-building laboratories, students are provided with more opportunities to contact the actual working environment, helping them accumulate rich practical experience during school. This cooperation mode helps improve students' professional skills and cultivate their professional quality and comprehensive ability to better meet the social needs for high-quality engineering drawing talent.

4. Combination of Theory and Practice

Combining theory and practice is particularly important in the teaching reform of engineering drawing courses in application-oriented universities. This combination is present in the teaching content and throughout the teaching process.

Regarding teaching content, integrating theoretical knowledge and practical operation is the primary task of reform. Traditional engineering drawing courses often focus too much on teaching theoretical knowledge and the importance of practical operation. Therefore, in the reform process, the proportion of teaching content must be re-adjusted to ensure that theoretical knowledge and practical operation complement each other. Specifically, case analysis and practical operation links closely related to practical application can be added to the course, such as introducing actual drawings of engineering projects for interpretation and drawing. It guarantees that students can deepen their understanding of theoretical knowledge in practice.

The combination of theory and practice must run through each teaching link in the teaching process. Teachers can use project-based teaching methods to decompose the course content into several specific practical projects. Students can master relevant knowledge and skills while completing the project. Teachers can also use modern teaching methods, such as three-dimensional modeling software and virtual reality technology, to create a more realistic and intuitive learning environment for students. It helps students better establish spatial concepts and improve their drawing skills.

Teaching reform should also focus on cultivating students' innovative thinking and ability to solve practical problems. Teachers can encourage students to try different drawing methods and techniques to explore a more efficient drawing process. Teachers can also guide students to pay attention to the frontier trends in engineering technology to cultivate their innovative consciousness and practical ability. Through these measures, students can better cope with various challenges in their future work and exert their professional advantages.

The combination of theory and practice is an important direction of the teaching reform of engineering drawing courses in application-oriented universities. By adjusting teaching content, optimizing the teaching process, and cultivating students' innovative thinking and practical ability, teachers can better adapt to social needs and cultivate professional talent with a solid engineering drawing foundation and good innovation ability.

5. Innovation Ability Training

Cultivating innovation ability is particularly important in the teaching reform of engineering drawing courses in application-oriented universities. It is not only because innovation ability is a necessary core quality for modern

engineers but also because it is a key factor in promoting the sustainable development of engineering technology. Therefore, in the teaching reform, teachers should emphasize stimulating students' innovative thinking and cultivating their ability to solve practical problems.

Case teaching is introduced into engineering drawing courses as an effective teaching method. By analyzing real engineering cases, students can be exposed to problems and challenges in practical work to stimulate their innovative thinking. Case teaching can help students understand how theoretical knowledge is applied and encourage them to improve and innovate existing engineering drawing methods and techniques.

The project-driven teaching method complements case teaching. In this way, students need to learn and practice around a specific project. Through the implementation of the project, students can deeply understand all aspects of engineering drawing and exercise innovative thinking and teamwork ability in solving practical problems. The project-driven teaching method encourages students to actively explore and solve problems to cultivate their independent thinking ability and innovative spirit.

In addition to introducing new teaching methods, teachers have added some innovative, practical projects to further enhance students' innovative abilities. These practical projects aim to enable students to conduct practical operations in a real engineering environment and exercise their drawing skills and innovation ability by mapping drawings and solving practical problems. In practical projects, students must fully exert their imagination and creativity to design engineering drawings that align with actual needs and innovation.

These teaching reform measures will cultivate excellent engineers with innovative thinking and problem-solving skills. They will be able to better adapt to the development needs of the engineering technology field and make important contributions to promoting industry progress and innovation. These teaching reform measures will also help improve the teaching quality of engineering drawing courses in application-oriented universities and cultivate more high-quality engineering talent.

6. Interdisciplinary integration

Interdisciplinary integration is an innovative and promising reform direction in the teaching reform of engineering drawing courses in application-oriented universities. This kind of integration helps expand students' knowledge and vision and improves their comprehensive quality to meet the diversified engineering needs of the future.

Combining engineering drawing with mechanics, materials science, computer science, and other disciplines can create a new and comprehensive teaching mode. In this mode, students can learn the professional knowledge of engineering drawing and dabble in the core content of other related disciplines. This interdisciplinary learning approach can help students fully understand the overall process and all aspects of engineering design.

For example, integrating mechanics knowledge into engineering drawing courses can enable students to understand the principles and requirements of structural design more deeply. Students can pay more attention to the rationality and stability of the structure in the drawing process. The introduction of materials science content will enable

students to better understand the properties and characteristics of different materials. It can help students select the appropriate materials more accurately when drawing. The integration of computer science can help students master modern design tools and techniques such as CAD and other design software to improve their design efficiency and accuracy.

The teaching mode of interdisciplinary integration can enrich students' knowledge systems and cultivate their multi-angle and all-around way of thinking. Students will learn to examine and solve engineering problems from the perspective of multiple disciplines, greatly enhancing their overall quality and ability to solve practical problems.

To achieve this reform goal, universities can jointly strengthen exchanges and cooperation with other disciplines and develop comprehensive curriculum resources and teaching cases. Students can be encouraged to actively participate in interdisciplinary research projects and practical activities to experience the advantages of interdisciplinary integration in practice. These measures can cultivate more excellent engineering and technical talent with comprehensive quality and innovation ability.

7. Conclusions

In optimizing the engineering drawing course system, teachers must focus on increasing practical operations, updating teaching content, and integrating interdisciplinary content.

The increase of practical operation is very critical. Engineering drawing is an efficient course. Students must improve their drawing skills and spatial imagination through continuous practical operation. Therefore, in the course design, teachers should arrange more experiments, training, and practice so that students can participate in all aspects of engineering drawing. Through practical operation, students can understand the principles and techniques of engineering drawing more deeply, improve their practical ability, and lay a solid foundation for their future careers.

The update of teaching content is indispensable. With the continuous development of science and technology, engineering drawing technology and methods are also progressing. To ensure that students' knowledge keeps pace with the industry needs, teachers must update the teaching content in time and introduce the latest engineering drawing techniques and methods. For example, computer-aided design software (CAD) teaching content can be introduced to enable students to master modern drawing tools and techniques. Experts in the industry can be invited to teach lessons or give lectures so that students can understand the latest industry dynamics and technical trends.

The integration of interdisciplinary content is an important aspect of curriculum system optimization. Engineering drawing is a professional course that is closely related to other disciplines. By introducing some interdisciplinary content, teachers can help students broaden their knowledge and enhance their comprehensive quality. For example, some basic mechanics and materials science knowledge is incorporated into the course so that students can better understand the overall engineering design process. Some computer science content can be introduced to help students understand the application of computer technology in engineering drawing.

By optimizing the engineering drawing course system, teachers can better cultivate students' practical and innovative abilities and improve their comprehensive quality. Students can better adapt to the needs of industry development. In the specific implementation process, teachers must constantly adjust and improve the curriculum system according to the actual situation to ensure effective teaching reform.

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