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Research and Practice on the Reform of Online and Offline Blended Teaching for Mechanical 3D Modeling Courses

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Abstract

In the context of first-class curriculum construction, as an important basic course for mechanical majors, the traditional teaching mode of UG three-dimensional courses has problems such as the disconnection between theory and practice and insufficient practical ability of students. This paper explores effective paths to improve students' practical ability and innovative by introducing online and offline mixed teaching mode, optimizing teaching content, innovating teaching methods and perfecting assessment mechanism, and provides practical references for the first-class curriculum of UG three-dimensional modeling courses.

Keywords

Online and offline mixed teaching; First-class curriculum construction; Teaching reform.

1. Introduction

With the rapid development of information technology and the increasing demand for three-dimensional design capabilities in modern manufacturing, UG three-dimensional modeling courses have become increasingly critical in mechanical engineering education. However, traditional teaching models suffer from issues such as monotonous teaching methods, weak practical components, and inadequate cultivation of students' autonomous learning abilities. To meet the requirements of first-class course construction, there is an urgent need to reform UG three-dimensional modeling courses.

By exploring and implementing online and offline blended teaching models, this study aims to address the shortcomings of traditional teaching methods. By integrating high-quality online resources and optimizing offline teaching activities, a more flexible and efficient teaching model is constructed. This reform not only improves teaching quality but also fosters students' autonomous learning abilities and innovative thinking, offering new approaches for cultivating high-quality mechanical talents.Based on this, the paper explores the protection and inheritance of traditional Thangka techniques through virtual reality technology, constructs a new development direction for intangible cultural heritage protection, and utilizes the power of the Internet to expand dissemination, allowing it to truly go global and face the future.

2. Analysis of Current Teaching Status for UG Three-Dimensional Modeling Courses

2.1. Limitations of Traditional Teaching Models

Traditional teaching models have the core advantages of systematic knowledge imparting and basic ability training, but there are also some shortcomings, as outdated teaching content, difficulty in meeting personalized learning needs, disconnection between theory and practice, and a single teaching method.

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2.1.1. Outdated teaching content

Currently, there is a widespread issue in the teaching of 3D modeling courses where the content of instruction lags behind the updates of software. Many colleges and universities still focus on explaining basic functions, lacking the introduction of new features and industry application cases. This lag causes a gap between the knowledge students learn the actual job requirements, affecting the employment competitiveness of graduates.

2.1.2. Difficulty in meeting personalized learning needs

In addition, traditional teaching methods struggle to meet students' personalized learning needs. The unified progress and fixed teaching content cannot take into account students with different foundations and learning abilities, resulting in some students falling behind the course progress, while others find the content simple. This "one-size-fits-all" teaching method limits students' creativity and personalized development and is not conducive to cultivating innovative talents.3. Disconnection between theory and practice: In traditional teaching, the proportion of theoretical explanation is too high, and the practical part is insufficient, making it difficult for to convert theoretical knowledge into practical skills.

2.1.3. Single teaching method:

Teacher-led teaching is the main method, with low student participation, lack of interaction and learning opportunities.

2.2. Advantages of Blended Teaching

Blended Learning combines the advantages of traditional face-to-face teaching and online learning, enhancing learning effectiveness through diversified teaching methods. core advantages include the following aspects:

2.2.1. Expansion of learning time and space

Online resources enable students to learn independently, while offline classrooms focus on practical operations and problem-olving. Students can break through time and space constraints, learning online course content through online platforms at any time and any place, no longer limited by the traditional classroom time and place they can also learn flexibly, using fragmented time for learning, such as completing online homework or watching teaching videos during their spare time.

2.2.2. Personalized learning support On the one hand,

Students can learn basic knowledge independently through online resources (such as videos, reading materials, online quizzes, etc.) before class, focusing on practice discussion, and problem-solving during class. Students can choose learning content according to their own progress, achieving autonomous learning. On the other hand, teachers provide targeted guidance through data, and teachers can also provide personalized guidance for students through data analysis, thus achieving individualized teaching.

2.2.3. Integration of practice and innovation:

By combining virtual simulation and actual, students' practical abilities and innovative thinking are cultivated.

Blended Learning, through the synergy of "online autonomy offline interaction," has achieved optimization of resources,, and effects, especially suitable for the personalized and efficient learning needs of the information age. Its success relies on reasonable curriculum design, technical support, and the adaptability of teachers and.

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3. Design and Implementation of Online-Offline Blended Teaching Model

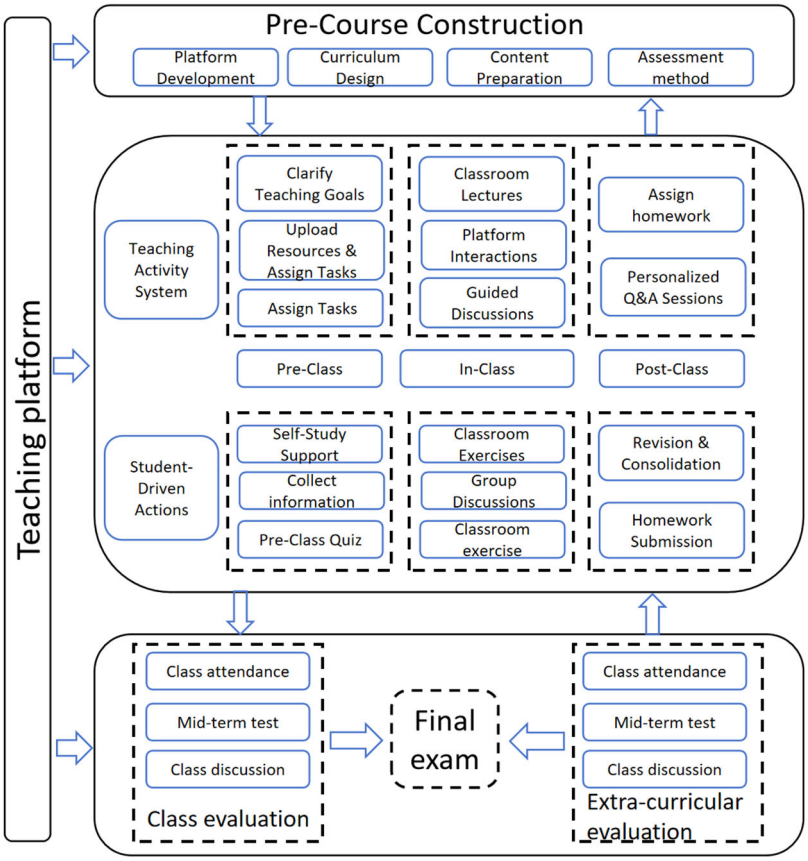

Figure 1. Multi-Platform Blended Teaching Model Flowchart

The design and implementation of online and offline mixed teaching mode is shown in Figure 1. For teachers, it is necessary to control the overall situation of the whole system such as early course construction, teaching activity system, assessment mechanism system and multi-platform support. It is necessary to start with the optimization of teaching content, the innovation of teaching and the reform of assessment methods.

3.1. Optimization of Teaching Content

In the mixed teaching mode of online and offline, the optimization of teaching content is the key to improve teaching effectiveness. In the early stage, online resources need to fully prepared, offline practice should be strengthened, and online and offline teaching activities should be fully integrated.

3.1.1. Online Resource Development

Firstly, the course website is built. A dedicated course website is established, which includes basic information such as course introduction, teaching syllabus, electronic, and teaching courseware. At the same time, a discussion area is set up to facilitate communication and interaction between students and teachers, as well as between students.

Secondly the teaching video production is carried out. A series of teaching videos are recorded, covering the explanation of modeling theoretical knowledge and the demonstration of software operation. The video content is subided according to the knowledge points, and the duration of each video is controlled within 10-15 minutes, which is convenient for students to learn in fragmented time.

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Finally, the online test and homework system is built. An online test and homework system is developed, and students can take an online test after completing the learning, to timely check the outcomes. The system automatically corrects homework and provides feedback on the students' learning situation, which provides a basis for teachers to adjust teaching strategies.

3.1.2. Offline Practical Enhancement

Offline practice reinforcement includes in-depth explanation of theoretical knowledge, practical operation guidance, and group collaborative learning.

(1) In-depth explanation theoretical knowledge: In the classroom, teachers provide in-depth explanations of key and difficult theoretical knowledge, helping students understand through practical cases. At the same time, students are encouraged to questions, and the teacher promptly answers students' questions.

(2) Practical operation guidance: Sufficient classroom practice time is arranged, and the teacher provides on-site guidance the students' practice process, correcting students' mistakes in operation in a timely manner, and guiding students to master the correct modeling methods and skills.

(3) Group collaborative learning Students are organized to carry out group collaborative learning, and group project tasks are assigned. Students complete projects through group discussion, division of labor and cooperation, and cultivate teamwork and skills.

3.1.3. Integration of Online-Offline Activities

Before class, teachers release preview tasks through the course website, students watch teaching videos, read relevant materials, and complete online preview tests. Teachers understand the' learning difficulties based on their preview situation, and adjust the classroom teaching content.

In the classroom, teachers provide a centralized explanation of the problems encountered during the students' preview, and then provide practical operation guidance and group project teaching. At the same time, online resources are used to assist teaching, such as displaying excellent cases through online platforms, and conducting-time interaction.

After class, students log in to the course website to review the content learned in the classroom, complete online homework and expand tasks. Teachers grade and evaluate students homework through online platforms, and provide timely feedback on students' learning situation. At the same time, online centralized Q&A is carried out for students' common problems.

3.2. Innovation in Teaching Methods

In the blended teaching mode of online and offline, the innovation of teaching methods is the key to achieve teaching objectives and improve learning outcomes. Here are some innovative teaching:

3.2.1. Flipped Classroom:

Teachers need to transmit knowledge to students before class. With the help of online teaching resources, teachers pre-record detailed video explanations of modeling theory basic operation demonstrations, and upload them to the course website. Students watch the videos on their own before class to complete the preliminary learning of knowledge. At the same time, teachers assign simple thinking questions or mini-tests to encourage students to think actively and deepen their understanding of the knowledge. For example, before explaining a complex modeling command, let students analyze application direction of this command in actual modeling scenarios after watching the video.

Teachers guide students to internalize the knowledge during class. Class time is mainly used for discussion, QA, and practical operation among students. Teachers guide students to have group discussions based on the content learned before class, share learning experiences and

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encountered problems. For the questions commonly existing among, teachers provide centralized answers. In the practical operation section, teachers strengthen on-site guidance to ensure that students can correctly apply the knowledge they have learned to carry out modeling practice and theoretical knowledge into practical operation ability.

3.2.2. Project-Driven Learning:

The project-based teaching method includes two stages: project design and project implementation. The teacher guides students to design a series of targeted and comprehensive projects on the characteristics of mechanical three-dimensional modeling courses and actual engineering needs. The projects cover different difficulty levels, from simple mechanical part modeling to complex mechanical assembly modeling. For example a project is designed for the modeling of a small mechanical transmission device, which requires students to complete the modeling of each part and the overall assembly, and to carry out motion simulation analysis In the classroom, the teacher divides the students into several groups, each of which is responsible for one project.

The following is an introduction to the project implementation process. In the classroom, the teacher divides the students into several groups, with each group responsible for one project. Group members determine the plan of the project through discussion and clarify their respective tasks and responsibilities. In the process of project implementation, students make full use of online and offline resources. Online, they consult relevant materials and watch teaching videos to solve technical problems they encounter; offline, group members cooperate with each other and carry out modeling operations under the guidance of the teacher. The teacher organizes project reports so that each group can show the progress of the project, and problems are found and guided in time.

3.2.3. Virtual Simulation Integration:

The professional mechanical design virtual simulation platform UG is introduced into the course teaching. Teachers use the virtual simulation platform to demonstrate the mechanical model for mechanical, motion simulation and other demonstrations. For example, when explaining the modeling of mechanical motion mechanism, the motion process and mechanical characteristics of the mechanism are intuitively displayed through the virtual simulation, which helps students better understand the modeling principle and practical application.

Students are self-regulatory simulation practice. After completing the modeling task, students use the virtual simulation to simulate and analyze the models they created. By observing the simulation results, students can test the rationality and accuracy of the model and further optimize the model. For example, the simulation analysis of the designed mechanical parts is carried out, and the structure parameters of the parts are adjusted according to the analysis results to improve the design quality. This kind of virtual practice not only enhances students'practical ability, but also cultivates students' engineering thinking and innovative ability.

3.3. Assessment Reform

The hybrid teaching method reforms the assessment methods for students, including theoretical knowledge assessment, practical operation assessment, project outcome assessment and innovation capability assessment.

3.3.1 Theoretical Knowledge Assessment: The traditional theoretical knowledge written examination is retained, but the proportion and types of questions are adjusted. In to testing basic modeling theory and software operation principles, more comprehensive and analytical questions are added. For example, a complex mechanical product design requirement is given, and students are to analyze which modeling ideas and methods should be adopted, and what

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key commands and knowledge points are involved, so as to test students' understanding and application of knowledge

3.3.2 Practical Operation Assessment: The proportion of practical operation in the assessment is increased. A special practical operation examination is arranged, requiring students to complete the given task within the specified time. The assessment content covers from simple part modeling to complex assembly modeling, as well as model rendering and animation production. For example, given a transmission system design drawing, students need to use the learned software to model accurately and assign materials and rendering to the model to show the final visual effect.

3.3.3 Outcome Assessment: For the group projects in the project-driven teaching method, the project outcomes are included in the assessment scope. The assessment not only focuses on the of the final model completed by the project but also includes the teamwork situation and problem-solving ability during the project implementation. For example, students are required to a project report, detailing the design ideas of the project, the problems and solutions encountered during the implementation process, and the specific contributions of each member in the project. make a comprehensive score according to the project report, model display, and group defense.

3.3.4 Innovation Capability Assessment: An innovation bonus item is set up to students to show innovative thinking in the modeling process. For example, if students can propose unique modeling methods, innovatively improve traditional designs, or have outstanding performances in function expansion, they can get corresponding innovation points.

4. Practical Outcomes of the Reform

Through the mixed teaching mode of online and offline, the students' learning autonomy and participation have been significantly improved. The flexibility and interactivity of resources enable students to learn at their own pace, while offline practice sessions enhance their learning motivation.

Students have shown excellent performance in UG three-dimensional skills, innovative design capabilities, and teamwork abilities. Through actual project operations and guidance from enterprise mentors, students can better transform theoretical knowledge into practical skills to meet the of enterprises.

By comparing the academic performance and practical achievements of students before and after the reform, it was found that the teaching effect of the mixed teaching mode superior to the traditional teaching mode.

5. Conclusion

The blended teaching model significantly improves learning outcomes and practical skills in UG three-dimensional modeling courses. It provides a replicable framework for first-class course development.

The online resource construction will be further optimized in the future, deep cooperation with enterprises will be strengthened, more practical projects and industry cases will be introduced, the application of artificial intelligence technology in teaching will be explored to provide students with a more intelligent and personalized learning experience.

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