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The Application of "Task-driven Approach" in Teaching Architectural CAD in Higher Education

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Abstract: *Teaching architectural CAD in higher education is an important part of cultivating students' practical application skills, and effective teaching methods are crucial to students' learning outcomes. The "task-driven approach" has been widely applied and studied in the teaching of architectural CAD in higher education. The task-driven approach takes students' task requirements as the starting point and core, using real-world problems as the basis of learning. By combining knowledge with practical applications, it encourages students to actively participate in learning and improves learning outcomes. Therefore, the task-driven approach has great potential for application in the teaching of architectural CAD in higher education and deserves further exploration and discussion.*

Keywords: *task-driven approach; higher education; architectural CAD teaching; application*

With the continuous development and popularization of CAD technology, it has become an indispensable tool in architectural design and drafting. Especially in the teaching of architectural disciplines in higher education, CAD technology has become one of the compulsory courses. However, due to the complexity of the knowledge structure in this field and the differences in students' learning interests, traditional teaching methods often fail to meet the teaching needs. Therefore, how to effectively integrate CAD technology teaching with learning objectives, and enhance students' learning interests and practical abilities, has become a hot topic in current higher education CAD teaching.

1. The Importance of the "Task-Driven Approach" in the Teaching of Architectural

CAD in Higher Education The task-driven approach is of great significance and value in the teaching of architectural CAD in higher education. Traditional teaching methods often revolve around teachers delivering knowledge while students passively receive it. In contrast, the task-driven approach takes students' practical needs and problems as the starting point, guiding them to actively participate in learning. By setting challenging tasks, it stimulates students' interest and initiative in learning, cultivates their critical thinking and problem-solving abilities. The task-driven approach combines theoretical knowledge with practical applications, enabling students to apply what they have learned to real-world problem-solving. Through the completion of practical tasks, students not only deepen their understanding of theoretical knowledge but also develop practical skills and experience, enhancing their overall abilities[1].

In the architectural CAD design process, teamwork is essential. The task-driven approach can design tasks that require students to collaborate, cultivating their teamwork, communication, and coordination skills. Through collaboration with others, students can learn from each other, solve problems together, and improve their teamwork abilities[2].The goal of teaching architectural CAD in higher education is to cultivate students' ability to independently complete practical tasks. The task-driven approach accomplishes this by setting specific architectural projects or practical cases as tasks, allowing students to apply their knowledge to practical problem-solving. The cultivation of practical application abilities equips students to better adapt to future job requirements and enhance their employability. The task-driven approach also enhances students' learning outcomes. By completing tasks, students engage in practical exercises and critical thinking about real-world problems, deepening their understanding and application of knowledge. After completing the tasks, students can showcase their achievements, further reinforcing their learning and improving the quality and effectiveness of their studies[3].

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2. Problem Analysis of CAD teaching in college architecture

2.1 Lack of Classroom Enthusiasm among Teachers

In the teaching of architectural CAD in higher education, the lack of enthusiasm from teachers in the classroom can lead to decreased learning outcomes and waning student interest. If the course design is unreasonable or overly traditional, lacking innovation and appeal, it can make the teaching content dull and uninteresting. Factors such as lack of interaction and practical exercises, insufficient case analyses, and real-world application scenarios can reduce student engagement and interest in learning. If teachers only adopt one teaching method, such as the traditional lecture mode, without diversifying their teaching methods, it may diminish students' enthusiasm for learning[4].As students have different learning styles and preferences for receiving information, a single teaching method may fail to meet the needs of different students. The core of teaching architectural CAD in higher education lies in the integration of theoretical knowledge with practical application. If teachers fail to provide practical opportunities and case analyses, focusing solely on delivering theoretical knowledge, students may struggle to apply their knowledge to practical situations and lack the cultivation of operational and comprehensive skills for CAD software. If teachers merely transmit knowledge in a one-way manner without engaging in interactive communication and mental training with students, students may easily find the learning process monotonous[5].

2.2 Lack of Student Interest in Learning

In higher education teaching, if the chosen teaching content is overly theoretical and disconnected from practical application scenarios, students may struggle to relate their CAD knowledge to real engineering projects. The lack of case analyses and practical exercises that involve real-world applications can result in a loss of student interest in learning. Outdated or incomplete teaching materials that fail to satisfy students' curiosity about new technologies and the latest CAD software can contribute to the waning interest in the course. The teaching of architectural CAD in higher education should focus on cultivating students' creativity and practical abilities. If the course solely emphasizes the transmission of theoretical knowledge without providing opportunities for stimulating students' thinking and offering creative design opportunities, students may find the learning process dull. The lack of student interaction and participation in the classroom, where teachers solely transmit knowledge without encouraging students' active thinking and questioning, can further diminish student interest in learning.

2.3 Lack of Student Creativity

In CAD teaching, teachers often focus on imparting theoretical knowledge and basic operational skills while neglecting the cultivation of students' creative thinking. Teaching methods that prioritize technical operations over creative thinking can lead to a lack of student creativity. When teachers fail to design tasks and activities that are challenging and inspiring for students in the classroom, students may lack opportunities to demonstrate and apply their creativity. Consequently, students may find themselves in a passive state of receiving knowledge without engaging in active creative thinking and practice. In CAD teaching, evaluation systems often focus on standardization and norms, emphasizing students' mastery of technical specifications and operational procedures. Such evaluation systems may limit students' space for demonstrating creativity and individualization in their designs.

3. Application of the "Task-Driven Approach" in Higher Education Architectural CAD Teaching

3.1 Carefully setting learning tasks to enhance students' enthusiasm for learning

The task-driven approach is an effective teaching method in higher education architectural CAD teaching that enhances students' enthusiasm and engagement by carefully setting learning tasks that integrate learning content with practical needs. Teachers can design tasks related to actual architectural projects based on students' learning goals and interests. In teaching, teachers set appropriate learning tasks for students, such as completing the construction drawings of actual architectural scenarios. These tasks enable students to apply their CAD knowledge to specific architectural designs, increasing their interest and motivation in learning. Open-ended tasks can be set to encourage students to provide diverse solutions and design ideas. By stimulating students' creativity and imagination, it promotes

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their creative design and practice within the CAD software. Adding elements such as design competitions to the tasks can further stimulate students' competitiveness and enthusiasm for learning.

Furthermore, the task-driven approach emphasizes active and cooperative learning. Students play an active role in the tasks, exploring and solving problems independently to complete them. Teachers can encourage students to collaborate in teams, promoting cooperative learning through group discussions, mutual exchanges, and sharing experiences. Such task design not only enhances students' enthusiasm for learning but also cultivates their teamwork skills and communication abilities.

Finally, the task-driven approach emphasizes feedback and evaluation. Teachers can provide timely feedback and evaluation on task completion, guiding and advising students on their design outcomes. By carefully examining and evaluating students' work, it stimulates their motivation to improve and enhances the positivity and interest in learning.

For example, in teaching the design of a simple house plan, the teacher can ask students to design a house plan with basic functional areas such as living room, bedroom, kitchen, and bathroom, and also require them to add appropriate details such as furniture, windows, and doors. To increase students' interest and creativity, various themes or scenarios can be provided for students to choose from, such as modern style or house design in a natural environment, allowing students to apply their preferences and interests to their designs. To assist students in completing the tasks, relevant reference materials and resources can be provided, such as architectural design manuals, CAD software tutorials, and design cases, enabling students to learn and draw from related knowledge and skills. By carefully setting learning tasks, students' enthusiasm and motivation for learning can be enhanced. By providing choices and themes, students can design according to their preferences and interests, increasing the enjoyment and motivation of learning. The objectives of the tasks are clear, and students need to think and make decisions based on the task requirements, thereby fostering their autonomous learning abilities.

3.2 Encouraging participation in work tasks to ensure students' engagement

In CAD teaching, teachers can present specific design tasks, such as designing an architectural floor plan, interior layout scheme, or landscape planning. The task-driven approach requires students to actively participate in work tasks to increase their learning investment and engagement. Teachers can organize small groups where students collaborate to solve practical design problems. Students need to discuss, negotiate, and cooperate to complete the tasks. This collaborative learning approach encourages students to share ideas, listen to others' opinions, and work together. Through interaction and communication with peers, students not only enjoy the sense of achievement brought by collaboration but also learn and inspire each other. Students need to apply CAD software for design, simulation, rendering, etc. This practical process allows students to deepen their understanding of CAD tool usage and improve their technical skills through solving real-world problems. Students encounter various practical problems during the process, such as floor planning, dimension adjustments, and material selection, and they need to analyze and solve them using their acquired knowledge and skills. This problem-solving process nurtures students' creativity and practical application abilities while boosting their confidence. The task-driven approach encourages students to showcase their work and receive evaluation and feedback. Students have the opportunity to present their design proposals to teachers and classmates, explaining their design ideas and strategies. This presentation and evaluation process not only enhances students' communication skills and critical thinking but also allows students to gain inspiration and improvement suggestions from others' feedback. Through dialogue and discussion with others, students continuously improve their design abilities and professional competence.

For example, when teaching architectural section drawing in CAD, the teacher can showcase real architectural section drawing examples for students to understand the design of different types of buildings. These examples can be section drawings of well-known architectural works or buildings near the school. Through the presentation of these cases, students can experience the application of section drawings in actual architectural design. The teacher can set specific architectural section drawing design tasks for students, such as asking them to select a building and use CAD software to draw its section. In the design task, students can be specifically instructed to consider factors such as the functional layout, structural characteristics, and internal zoning of the building. The teacher can also encourage students to unleash their imagination and try different design styles and creative elements. During the teaching process, the teacher can provide specific operational guidance for CAD software, guiding students in becoming familiar with the software's usage skills and mastering section drawing techniques. The teacher can demonstrate CAD software operation steps through practical

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demonstrations and answer students' questions. Through guided practice, students gradually improve their CAD technical proficiency and enhance their practical skills in architectural section drawing.

Next, the teacher can encourage students to collaborate in small groups. Each group is responsible for a section drawing design task and collaboratively discuss and determine the design solution. During the task, the teacher can organize sharing and exchanges of design progress among students, enabling them to learn from and inspire one another. The teacher can provide regular feedback and evaluation, encouraging students to continuously improve and enhance their designs. Upon task completion, the teacher can organize design showcases and discussions among students. Students can present their architectural section drawing designs to the class, explaining their design ideas and inspirations. Through showcasing and discussion, students can receive feedback and comments from the teacher and classmates, further refining and improving their design proficiency. Through this teaching approach, teachers can stimulate students' interest in learning, improve their design abilities and creativity, and foster their teamwork and problem-solving skills. Adjustments and extensions can be made according to specific circumstances to meet students' needs and course objectives.

3.3 Changing traditional teaching methods to cultivate students' autonomous learning awareness

Traditional teaching models often revolve around teachers transmitting knowledge as the core, with students being passive recipients. However, with the task-driven approach, students become the main participants in learning, driving the learning process through completing specific design tasks. They need to think critically and apply their acquired knowledge to problem-solving, thus cultivating their ability and awareness for autonomous learning. Students need to utilize CAD software for design, simulation, rendering, etc., converting theoretical knowledge into practical application abilities. They encounter various real-world problems that require analysis and solutions, fostering their creativity and problem-solving skills. Through practice, students gain a deeper understanding of CAD tool usage and strengthen their grasp of design principles. In a task-driven learning environment, students are organized into teams to collaboratively complete design tasks. They engage in discussions, negotiations, and practical work to solve problems together. This collaborative learning approach cultivates students' cooperative spirit and teamwork awareness. Through interaction and communication with peers, students can gain different perspectives and ideas, inspiring and learning from each other, ultimately enhancing their design proficiency and competence. Students have the opportunity to showcase their design outcomes to teachers and classmates and share their design concepts and strategies. This process of presentation and evaluation enhances students' expressive skills and critical thinking while allowing them to gain inspiration and improvement suggestions from others' feedback. Students can continuously refine their design works and improve their professional competence and abilities through evaluation and feedback.

For instance, in course design, teachers can guide students' CAD learning by setting different types of design tasks. For example, students can be asked to design a simple architectural floor plan and gradually progress to more complex architectural designs, such as interior layout and façade design. The difficulty of the tasks can be adjusted moderately according to students' learning progress, stimulating their interest in learning while challenging their abilities. In CAD teaching, students can practice design operations using professional CAD software. For example, they can be asked to create a 3D architectural model using CAD software and perform rendering and animation demonstrations. Through practical operation, students not only gain a deeper understanding of CAD tool usage but also improve their design abilities and innovative thinking. In CAD teaching, students can collaborate in groups for design tasks. For example, they can form teams to collaboratively design an architectural project, sharing the workload and working together. Students need to engage in discussions, negotiations, and practical work to solve problems collectively. Through interaction and communication with peers, they can gain different perspectives and ideas, inspiring and learning from one another.

Regarding student presentation and evaluation, teachers can encourage students to showcase their design outcomes to teachers and classmates and share their design concepts and strategies. For example, design exhibitions can be organized for students to showcase their design works and receive feedback and evaluation from teachers and classmates. Through these presentations and evaluations, students enhance their expressive skills and critical thinking, while also gaining inspiration and improvement suggestions from others. They can continuously refine their design works and improve their design proficiency and professional competence.

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4. Future Prospects of the "Task-Driven Approach" in Higher Education Architectural CAD Teaching

With the continuous advancement of technology and innovation in educational methods, the task-driven approach, which focuses on cultivating students' practical operations and problem-solving abilities, can allow students to engage in more practical design operations on CAD software and gain hands-on experience. With the development of technologies such as virtual reality (VR) and augmented reality (AR), the task-driven approach can integrate these technologies to provide more realistic and immersive design experiences, further enhancing students' practical skills. Architectural CAD design involves multiple disciplinary areas, such as architecture, structural engineering, interior design, etc. In the future, the task-driven approach can introduce interdisciplinary collaboration, fostering students' comprehensive abilities and teamwork spirit through interdisciplinary project teams. For example, students can collaborate to complete a complete architectural design project that requires teamwork from architectural concepts to construction drawings.

In task-driven teaching, with the development of artificial intelligence (AI) and machine learning, real-time feedback and intelligent assistance can be introduced. By analyzing students' operations and decisions in the CAD design process, the system can provide real-time evaluations and suggestions, helping students improve their design work. Intelligent assistance tools can also provide more design resources and reference materials, enriching students' design ideas and creativity. The task-driven approach focuses on the cultivation of students' comprehensive abilities and can further strengthen the development of their comprehensive qualities in the future. For example, project management and sustainable design-related content can be introduced, allowing students to consider social, environmental, and economic factors in the design process, cultivating their comprehensive thinking and sense of responsibility. The task-driven approach can leverage online learning platforms and collaboration tools to achieve remote learning and cross-regional collaboration. Students can access teaching resources and guidance through online platforms, engage in online communication and discussions with classmates and teachers, and achieve information sharing and collaborative design. The development of this model can increase the flexibility and coverage of teaching, benefiting more students.

5. Conclusion

The application of the task-driven approach in higher education architectural CAD teaching enables students to actively participate and engage in practical operations, fostering their design thinking and problem-solving abilities. By simulating real-world project scenarios and incorporating interdisciplinary collaboration, the task-driven approach can cultivate students' comprehensive abilities and teamwork spirit, bringing more innovation and development opportunities to higher education architectural CAD education. It is hoped that the task-driven approach will be widely applied in higher education architectural CAD teaching, continuously improved and developed, making greater contributions to the cultivation of excellent architectural design talents.

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