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Application of Constructivist Learning Theory in Engineering Drawing Teaching under the Blended Learning Model

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Abstract: With the rapid development of educational informatization, the blended teaching model has been increasingly widely used in the field of education due to its advantages of flexibility, personalization and efficiency. This paper aims to explore the application of constructivist learning theory in engineering drawing teaching under the blended teaching model. By analyzing the core ideas of constructivist learning theory and the characteristics of blended teaching model, the relationship between the two is found, and their applicability in engineering drawing teaching is analyzed in detail. This paper proposes specific teaching strategies and verifies their effectiveness and feasibility through actual teaching cases. Practice has proved that the blended teaching model combined with constructivist learning theory can significantly improve the teaching quality of engineering drawing courses. Students can not only master basic knowledge in autonomy, collaboration, sharing and reflection, but also improve their spatial imagination, hands-on ability and innovation ability. At the same time, the role of teachers has also changed from knowledge transmitters to helpers and promoters of students' active construction of meaning, which has promoted effective interaction and common development between teachers and students. In addition, this theoretical research also provides new perspectives and ideas for the reform of engineering drawing teaching.

Keywords: blended learning, constructivism, engineering drawing, teaching strategy, teaching effect

1. Introduction

In recent years, with the rapid development and breakthrough progress of information technology and mobile Internet, especially in the post-COVID-19 era, the development of educational informatization has been greatly promoted. In the field of higher education, the blended teaching model has been increasingly widely used and has become an important teaching model in the Internet plus era. The blended teaching model combines the advantages of online and offline teaching, providing students with a more flexible and personalized learning experience. At the same time, the traditional constructivist learning theory[1] has also been more deeply and specifically applied under the new teaching model. The constructivist learning theory emphasizes that learners actively construct knowledge through interaction and collaboration with others in a specific context. In the context of today's engineering education certification, engineering drawing is a basic core course of engineering majors in colleges and universities. Its teaching quality directly affects the cultivation of students' engineering literacy. In engineering drawing teaching, students are required to master a lot of drawing skills and theoretical knowledge, and traditional teaching models often fail to meet students' personalized learning needs. The blended teaching model and constructivist learning theory can fit well with this course and provide better support in engineering drawing teaching. Therefore, this paper will explore the application of constructivist learning theory in engineering drawing teaching under the blended teaching model, in order to provide new ideas and methods for engineering drawing teaching.

2. Literature Review

For centuries, lectures were the most commonly used teaching approach in higher education. But Lectures or traditional teaching are now described as being passive teaching models because they discourage students from critically filtering the delivered information. Focusing only on face-to-face interaction does not provide space for collaborative learning, nor does it allow instructors to implement higher-level thinking skills. Such a paradigm shift from traditional teaching to an online environment is considered a challenge for many instructors in higher education [2]. Most college students find what they are taught in class boring, and they usually find the classroom atmosphere unmotivating or unsupportive, leading to low attendance, more behavioral problems, or lack of participation. At the same time, the increasing popularity of new technologies has changed students' behaviors and attitudes, and also changed the way they learn, communicate, and engage in extracurricular activities. For example, computers, smartphones, tablets, and online games shorten students' attention spans and distract them from remembering information. As a result, teachers are forced to restructure the learning process and adjust class materials to accommodate this change, which has promoted the emergence and development of blended teaching models.

Xie[3] reported that with the development of "Internet plus", blended teaching has become the new normal in the field of education in China and abroad. This model breaks the time and space limitations of the traditional education model

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through the organic integration of "online self-learning" and "offline flipped classroom" teaching, so that online and offline teaching can complement each other and promote each other, from passive learning to active learning, and knowledge acquisition from shallow to deep. Blended teaching has become the mainstream teaching trend in colleges and universities. However, due to different types of courses, there are many types of blended teaching methods, and the research results of blended teaching methods on improving students' learning effects are also different. However, it is generally believed that blended learning refers to a teaching model that combines traditional face-to-face teaching with online learning. It aims to improve learners' learning experience and learning outcomes by integrating multiple teaching methods. In this model, students can interact with teachers and classmates in class, while also learning and accessing resources independently through online platforms, thus achieving flexible learning arrangements and personalized learning paths[4].

The emergence of blended teaching model has also led to the integration of constructivist learning theory and new teaching models. Constructivism was first proposed by Swiss psychologist Piaget. In his research on children's cognitive development, he found that in the process of interacting with the surrounding environment, children gradually construct knowledge about the external world, thereby developing their own cognitive structure. Li[5] reported that constructivism is a further development of learning theory from behaviorism to cognitivism. Constructivism believes that learning is the process of acquiring knowledge, and knowledge is not obtained through teachers' teaching, but is acquired by learners in a certain context, with the help of others, using necessary learning resources, and through the construction of meaning. Therefore, in a constructivist learning environment, students are the main body of learning, and the role of teachers is to stimulate students' interest in learning, and strive to encourage students to connect the things reflected in the current learning content with what they know as much as possible. By creating situations that meet the requirements of the teaching content and clues to the connection between new and old knowledge, help students construct the meaning of the current knowledge they have learned, and organize collaborative learning under the best conditions, and guide the collaborative learning process to develop in a direction that is conducive to the construction of meaning.

Constructivist learning theory believes that knowledge is not obtained through teaching, but that learners' knowledge is acquired in a certain context, with the help of others, using necessary learning materials, and through the construction of meaning. The ideal learning environment should include four parts: situation, collaboration, communication, and meaning construction. This theory emphasizes student-centeredness, pays attention to the situational, participatory and interactive nature of learning, and believes that students are active constructors of knowledge meaning. Chen[6] reported that the engineering drawing course has the characteristics of abstraction, complexity, and practicality, and engineering drawing is suitable for teaching guided by constructivist theory. Students construct knowledge independently and actively absorb knowledge in a certain situation, which is convenient for students to master the basic principles and methods of drawing and cultivate a spirit of cooperation.

However, from the perspective of teaching practice, the traditional teaching of engineering drawing courses has not fundamentally broken through the teaching model centered on teachers and classrooms and mainly imparting theoretical knowledge in a one-way manner. Students are overly dependent on teachers in the learning process, lack initiative, and are in a passive and mechanical learning state. The education and learning model within the framework of the traditional education model cannot meet the social development requirements with knowledge innovation as the demand[7].

Constructivist theory has been widely used in the field of education, especially in engineering education. Its core concept is that learners construct knowledge through active participation and social interaction. In engineering education, constructivism not only focuses on the transfer of knowledge, but also emphasizes students' exploration and cooperation in practice. Studies have shown that teaching methods such as project-based learning (PBL) and flipped classrooms can significantly improve students' participation and learning achievement. For example, Gültekin[8] et al. found that PBL improved students' design ability and teamwork ability, while Zainuddin and Perera[9] showed that the flipped classroom model improved students' understanding ability. Constructivist teaching methods have a positive impact on students' learning achievement. López-Pérez[10] et al. conducted a survey of several engineering colleges and found that students performed better in final exams in courses using constructivist methods than in traditional teaching. Constructivist teaching not only focuses on student grades, but also emphasizes the cultivation of comprehensive abilities. In addition, through the constructivist approach, students have significantly improved in critical thinking, problem-solving skills, and teamwork skills[11]. Nevertheless, challenges in the transformation of teacher roles and student assessment methods still exist. Overall, constructivism brings new perspectives and innovative teaching methods to engineering education, and future research can further explore its effects in different disciplines and educational stages.

With the help of information technology, the blended teaching model can replaceably integrate constructivist learning theory. Song[7] reported that online and offline blended teaching refers to moving the knowledge content in the traditional teaching model to online for students to learn independently, while offline teaching focuses on the teacher's learning guidance, usually using task-driven, project-discussed or flipped classroom teaching methods. This new teaching method not only improves the efficiency of classroom teaching and promotes the improvement of students' independent learning ability, but also embodies the "student-centered" teaching concept.

In short, the combination of blended teaching model and constructivist learning theory provides new methods and ideas for engineering drawing teaching. Through flexible learning methods and teaching design that emphasizes student initiative, this model not only improves learning effects, but also cultivates students' practical ability and problem-solving ability. Future research can further explore the application of blended teaching in different subject areas to promote innovation and development of education.

3. The fit between blended teaching model and constructivist learning theory in engineering drawing teaching

3.1 The relationship between constructivist learning theory and engineering drawing teaching

Constructivism theory is an important branch of cognitive psychology, which emphasizes the initiative and constructivism of learners in the process of knowledge acquisition. This theory has a direct and far-reaching impact on students' performance in engineering drawing, which is specifically reflected in the following aspects:

Change learning concepts and stimulate learning motivation: Constructivism theory emphasizes that knowledge is not objective and fixed, but an interpretation or hypothesis of the objective world. This view prompts students to realize that engineering drawing knowledge is not just a series of fixed rules and techniques, but can be continuously developed and improved through their own active exploration and construction. This understanding stimulates students' learning motivation and makes them more actively involved in the study of engineering drawing.

Student-centered, focusing on individual differences: Constructivism theory emphasizes student-centeredness and focusing on students' initiative and constructivism. In the teaching of engineering drawing, this means that teachers need to pay attention to students' individual differences and respect their learning methods and rhythms. By creating appropriate teaching situations, providing rich learning resources, and encouraging students to explore and learn according to their own experience and interests, the learning needs of students at different levels can be met. This teaching method helps to stimulate students' interest in learning and improve their learning effects.

Emphasize situational learning and promote knowledge application: Constructivist theory believes that learning is carried out in a certain context, and knowledge is constructed through practice and application in a specific context. In the teaching of engineering drawing, teachers can create situations related to engineering practice, so that students can learn and apply drawing knowledge in real or simulated situations. This kind of situational learning not only helps students understand and master knowledge, but also cultivates their practical ability and problem-solving ability.

Strengthen cooperative communication and realize meaning construction: Constructivist theory emphasizes the important role of cooperative communication in knowledge construction. In the teaching of engineering drawing, teachers can encourage communication and cooperation among students through group discussions, project cooperation and other methods. By jointly solving problems, sharing experiences and results, students can inspire and complement each other, thereby achieving a deeper level of knowledge construction. This kind of cooperative communication not only helps to improve students' drawing skills, but also cultivates their teamwork and communication skills.

Focus on the guiding role of teachers and promote effective learning: Under the guidance of constructivist theory, the role of teachers in engineering drawing teaching has changed from knowledge transmitters to guides and promoters of learning. Teachers need to pay attention to students' learning process, provide necessary guidance and support, and help them solve problems encountered in learning. At the same time, teachers also need to encourage students to reflect and summarize to promote their in-depth learning. This teaching method helps to improve students' autonomous learning ability and problem-solving ability.

In summary, constructivism theory directly affects students' performance in engineering drawing by changing students' learning concepts, focusing on individual differences, emphasizing situational learning, strengthening cooperative communication, and focusing on the guiding role of teachers. These influences not only help to improve students' drawing skills and problem-solving abilities, but also cultivate their autonomous learning ability and teamwork ability, laying a solid foundation for their future development.

3.2 Characteristics of blended teaching model and its application in engineering drawing teaching

The blended teaching model combines the advantages of online and offline teaching, providing learners with a more flexible and personalized learning experience. In engineering drawing teaching, the application of blended teaching model has the following characteristics:

Online learning resources are rich and diverse: Through the online platform, students can access rich engineering drawing teaching resources anytime and anywhere, such as video tutorials, PPT courseware, online quizzes, etc. These resources help students learn independently and consolidate knowledge.

Offline practical activities strengthen skills: Offline teaching focuses on the organization and implementation of practical activities, such as drawing exercises, laboratory operations, etc. These practical activities help students apply what they have learned to actual situations, improve drawing skills and problem-solving abilities.

Personalized learning path: The blended teaching model allows students to choose a learning path that suits them according to their own learning progress and interests. This personalized learning method helps to improve students' learning motivation and autonomous learning ability.

In the teaching of engineering drawing, the application of blended teaching model can be reflected in the following aspects:

Online preview and review: Through the online platform, students can preview before class to understand the main content and difficulties of this class; review after class to consolidate the knowledge learned.

Offline explanation and demonstration: In class, teachers can introduce the basic theory and drawing skills of engineering drawing to students through explanation and demonstration. At the same time, teachers can analyze and discuss with specific cases to help students deeply understand knowledge and skills.

Group cooperation and practice: Through group cooperation, students can complete drawing tasks or solve practical problems together. This kind of cooperation method is conducive to mutual learning and common progress among students.

3.3 The fit between blended teaching model and constructivist learning theory

After the above theoretical analysis, it is found that the blended teaching model and constructivist learning theory have a good fit in the teaching of engineering drawing courses, which is specifically manifested in the following aspects:

Emphasis on student-centeredness: Both the blended teaching model and constructivist learning theory emphasize student-centeredness, focus on stimulating students' interest and enthusiasm in learning, and encourage students to actively construct knowledge. In the teaching of engineering drawing courses, teachers can use online resources to guide students to learn independently, and at the same time conduct discussions and practices in offline classes to stimulate students' learning interest and initiative.

Focus on the context of learning: Constructivist learning theory emphasizes the importance of context in knowledge construction, and the diverse online resources in the blended teaching model can provide students with rich contextual materials. In the teaching of engineering drawing courses, teachers can use online resources to display engineering examples and drawings, create contexts related to the course content, and help students better understand and master knowledge.

Emphasize collaboration and conversation: Constructivist learning theory focuses on the interaction between learners and the surrounding environment, and advocates collaborative and conversational learning methods. Offline classes in blended teaching models can provide students with opportunities for collaborative learning, allowing students to jointly construct knowledge through discussion and practice. In the teaching of engineering drawing courses, teachers can organize students to conduct group discussions, mutual evaluation of homework and other activities to promote students' collaborative learning and knowledge construction.

Emphasize the guiding role of teachers: Both the blended teaching model and the constructivist learning theory believe that teachers should play a guiding role in the teaching process. In the teaching of engineering drawing courses, teachers can use online resources to guide students to learn independently, and answer questions and conduct heuristic teaching in offline classes to help students better understand and master knowledge.

In summary, the fit between the blended teaching model and the constructivist learning theory lies in that both emphasize the initiative, interactivity and context of learning. By integrating the concept of constructivism into blended teaching, educators can create a more effective and meaningful learning experience, helping students better master knowledge and cultivate the ability to solve practical problems. This fit provides innovative ideas and practical directions for modern education.

4. Application strategies of constructivist learning theory in engineering drawing teaching under blended teaching model

The blended teaching model is a learning method that combines the advantages of traditional learning methods with the advantages of digitalization, and complements the advantages of in-class and extracurricular learning in an organized, planned, and clear learning goal. It can not only give full play to the leading role of teachers in guiding, inspiring, and monitoring the teaching process, but also fully reflect the initiative, enthusiasm, and creativity of students as the main body of the learning process. The constructivist learning theory has put forward a series of new explanations for learning and teaching, providing a new perspective for teaching reform. This theory emphasizes the main role of students in learning, and requires a change in the traditional roles of teachers and students, from focusing on the teacher's "teaching" to emphasizing the students' "learning". However, there are thousands of university courses, and each course has the most suitable teaching method[8]. Based on the characteristics of constructivist learning theory and blended teaching model, this paper designs the following specific teaching strategies:

Creating specific situations: During the teaching process, teachers should create specific situations related to engineering drawing, such as mechanical parts drawing, architectural electrical drawing, etc. These situations help students apply what they have learned to practical situations and improve their drawing skills and problem-solving abilities.

For example, when teaching architectural electrical drawing, teachers can combine specific cases to let students understand the drawing process and requirements of architectural electrical drawings. At the same time, teachers can provide relevant architectural electrical drawing samples for students to perform practical operations and exercises.

Student-centered, promote active learning: Teachers should give students the initiative to learn and encourage them to explore and learn by themselves. Implement flipped classrooms, issue learning tasks before class, and conduct in-depth discussions and practices in class to deepen students' understanding of knowledge. Feedback and evaluation should also be provided in a timely manner, and students' learning performance should be given timely and specific feedback. At the same time, students should be guided to provide self-feedback and reflection to help them recognize their progress and areas for improvement. How to ensure the learning effect of students is an important issue to be solved by blended teaching [9]. In order to ensure the teaching effect of blended teaching, teachers must also effectively manage students' online learning behavior.

Promote student interaction and collaboration to achieve meaning construction: In the teaching process, teachers should encourage interaction and collaboration among students. Through group discussions, cooperative learning and other methods, students can work together to solve problems, share experiences and resources. This interactive and collaborative method helps students to deeply understand knowledge and skills and promote the construction and transfer of knowledge.

For example, when teaching mechanical parts drawing, teachers can divide students into several groups, each of which is responsible for drawing a specific mechanical part. Group members can divide the work and cooperate to complete the

drawing task together. In this way, students can learn from each other and draw on experience to improve their drawing skills and teamwork ability.

Provide personalized learning resources: In the online platform, teachers should provide a variety of personalized learning resources to meet the learning needs of different students. These resources can include video tutorials, PPT courseware, online quizzes, etc. At the same time, teachers should make recommendations and guidance based on students' learning progress and interests, and help students choose a learning path that suits them.

Strengthen practice and application: In the teaching process, teachers should focus on the organization and implementation of practical activities. Set up special practical training courses to allow students to practice drawing in simulated or real engineering environments. Students can apply what they have learned to actual situations. Through practical training, students can master more practical skills and improve their ability to solve practical problems. At the same time, pay attention to introducing national and industry standards and specifications to ensure that the drawings drawn by students meet the actual engineering requirements. By introducing typical actual engineering cases, students can read and understand the drawings, thereby cultivating their spatial imagination and practical ability. Organize students to visit engineering sites or factory enterprises to let students experience the practical application of engineering drawing. For example, students can be organized to visit chemical plants, construction sites, etc. to understand the actual situation of equipment layout, pipeline laying, etc. This can not only enhance students' perceptual understanding, but also help them better understand the drawing methods and specifications of engineering drawings.

5. Teaching Case and Effect Analysis

Practice is the fundamental way to verify the correctness and practicality of theory. By applying theory to actual situations and observing its effects, we can comprehensively evaluate the feasibility, effectiveness and applicability of the theory. In this process, if we find that there are deviations or deficiencies between theory and practice, we can adjust and optimize it according to the results of practice to make the theory more perfect and more in line with actual needs. Therefore, it is necessary to evaluate the teaching strategies proposed above through teaching practice.

5.1 Teaching Case

In order to verify the effectiveness and feasibility of the above teaching strategies, this paper takes the engineering drawing course of Class 1-4 of the 2023 electrical engineering undergraduate major of our school as an example. Class 1-2 is selected as a teaching class (hereinafter referred to as the blended teaching class), with a total of 60 students, and the above blended teaching model and the teaching strategy of constructivist learning theory are fully adopted for teaching; Class 3-4 is selected as a teaching class (hereinafter referred to as the traditional teaching class), with a total of 58 students, and the traditional classroom teaching method is fully adopted for teaching, and a one-semester control experiment is conducted.

In the specific teaching process, for traditional teaching classes, we adopt the same traditional classroom teaching methods as before, which will not be elaborated in detail here. For blended teaching classes, we organize teaching completely according to the newly proposed teaching strategies, carefully consider and reasonably allocate online and offline teaching content, as follows.

Online teaching content allocation

Basic knowledge and preview: The online part can cover the learning of basic knowledge, such as the basic concepts of points, lines, and surfaces, as well as the basic theory of three-dimensional shapes. These contents can be presented in the form of short videos, animations or online courses. Each video or course focuses on 1-2 knowledge points, and the duration is controlled at about 15 minutes, which is convenient for students to master and understand quickly. Pre-class preview is also an important part of online teaching. Teachers can release preview materials in advance, including videos, PPTs or documents, to guide students to understand the content to be learned in advance and form a preliminary knowledge framework.

Autonomous learning and tasks: Relying on online teaching platforms, such as the Fan Ya teaching platform, teachers can set learning tasks such as pre-class preview, pre-class test and chapter exams. These tasks can help students self-test their learning results and stimulate their enthusiasm for autonomous learning. The system automatically evaluates students' learning outcomes and provides real-time feedback to teachers, so that teachers can understand students' learning situation in a timely manner, and provide targeted explanations or adjust teaching plans for difficulties and key points.

Case analysis and discussion: Case analysis, group discussion and other activities can also be arranged online, especially in the stage where high-level case analysis is the main focus. These activities can help students combine theoretical knowledge with practical applications and improve their ability to analyze and solve problems.

Offline teaching content distribution

In-depth explanation and interaction: Offline teaching can focus on in-depth explanation and teacher-student interaction. In face-to-face classes, teachers conduct in-depth analysis of the difficulties and key points in online learning, and help students deepen their understanding and memory of knowledge through example demonstrations, group discussions, and collective discussions.

Practical training and skill improvement: Offline teaching should also include practical training, such as actual operation of CAD drawing software, three-dimensional modeling design, etc. These practical trainings can help students transform theoretical knowledge into practical skills and improve their application capabilities in engineering drawing.

Situational simulation and problem solving: Teachers can create situations that meet the requirements of teaching content in offline teaching, guide students to further consolidate the knowledge they have learned through situational simulation, problem solving and other methods, and cultivate their practical ability and innovative thinking.

In short, the integration of constructivist learning theory, the reasonable distribution of online and offline teaching content, and the combination of the advantages of online and offline learning can improve students' participation and flexibility. At the same time, it provides opportunities for personalized learning, allowing students to learn at their own pace, and also enhances teacher-student interaction. In addition, it also encourages students to learn independently and cultivate critical thinking.

5.2 Effect Analysis

The students in the two teaching classes are all freshmen who have just entered the freshman year and are randomly divided into classes. There is basically no difference in average academic performance and learning ability. The teaching of the two teaching classes strictly follows the syllabus and adopts the same teaching hours and teaches exactly the same teaching content, but uses differentiated teaching models and teaching strategies in teaching. In addition, in addition to the basic hours arranged according to the syllabus, all students in the two teaching classes are not restricted to the extracurricular independent learning time for the course, which is arranged by them voluntarily.

After one semester, the teaching effect was evaluated based on the final exam scores and questionnaires of the students in the two teaching classes. Considering the consistency of the teaching effect evaluation of the two teaching models, the unified final exam score evaluation was used as the main method, but the final exam score could not fully reflect the dynamic and process-based assessment requirements, so a simple questionnaire survey was used as an auxiliary method for teaching effect evaluation.

Analysis of final exam scores

The distribution of student scores in the two control classes is shown in Table 1.

Class Type	Number of students	Number of people in each score range (percentage)					Average score
		0-59	60-69	70-79	80-89	90-100	
Blended teaching classes	60	0 （0%）	7 (11.7%)	23 (38.3%)	20 (33.3%)	10 (16.7%)	82.5
Traditional teaching class	58	1 (1.7%)	9 (15.8%)	24 (41.4%)	18 (31%)	6 (10.3%)	78.8

Table1：Comparison table of final grades for engineering drawing in the 2023-2024-1 semester

From the comparison table of the final exam scores of the two teaching classes, it can be seen that the average score of the blended teaching class is significantly higher than that of the traditional teaching class, and the number and percentage of excellent students (scores above 90 points) in the blended teaching class are also significantly higher than those in the traditional teaching class. This data shows that the use of blended teaching model and the teaching strategy of constructivist learning theory can significantly improve students' knowledge level and knowledge application ability, and also significantly improve the teaching effect.

Analysis of student questionnaire survey results

After the course study, a questionnaire survey was conducted on the students in the blended teaching class. In order to protect the privacy of the respondents and obtain more authentic and reliable survey results, the survey was conducted anonymously online. In the end, 56 valid questionnaires were collected, accounting for more than 93% of the respondents. The survey conclusion is credible.

The results of the questionnaire survey show that: 91.1% of the students believe that blended teaching helps them master course knowledge, 89.3% of the students believe that blended teaching improves their professional knowledge and comprehensive ability, 83.9% of the students believe that blended learning helps to enhance interaction and collaboration among students, and 82.1% of the students believe that blended teaching can enhance their autonomous learning ability and improve their learning initiative. From the results of the questionnaire survey, it can be seen that the vast majority of students have a high degree of recognition of the blended teaching model.

Through the comparison of final exam scores and the analysis of questionnaire survey data, it can be found that the blended teaching model can significantly improve students' autonomous learning ability, teamwork ability and engineering drawing skills, and can help students learn to think independently, explore problems and express their own ideas in the learning process. At the same time, students also have a high degree of recognition of the blended teaching model and constructivist learning theory, and believe that this teaching model can better meet their learning needs.

6. Conclusion

This paper studies and analyzes the application of constructivist learning theory in engineering drawing teaching under the blended teaching model, and draws the following conclusions:

Constructivist learning theory has important application value in engineering drawing teaching. By creating specific situations, promoting student interaction and collaboration, and other strategies, students' learning interest and initiative can be stimulated, and teaching effectiveness can be improved.

The blended teaching model combines the advantages of online and offline teaching, providing learners with a more flexible and personalized learning experience. In engineering drawing teaching, the application of blended teaching model can significantly improve teaching quality and students' learning motivation.

Through the analysis and verification of specific cases, the teaching strategy designed in this paper has achieved remarkable results in the application of constructivist learning theory in engineering drawing teaching under the blended teaching model.

Meanwhile, in the process of teaching practice, we have gradually discovered that the application of constructivist learning theory in engineering drawing teaching may face some shortcomings, including:

Difficulties in teaching implementation: Both the blended teaching model and the constructivist learning theory require teachers to change their traditional teaching concepts, from knowledge transmitters to learning guides and promoters. However, this is a huge challenge for teachers, requiring higher teaching skills and richer teaching experience. At the same time, students also need to change from passive recipients to active constructors, which also puts higher demands on their learning habits and autonomous learning ability.

Technology dependence: Blended teaching is highly dependent on technology. If students or teachers have obstacles in the application of technology, it may affect the learning effect. In addition, the stability and security of the network platform are also issues that need to be considered.

Limitations in evaluation methods: Traditional evaluation methods may not fully reflect students' actual performance and progress in constructivist learning.

In summary, although the application of constructivist learning theory in engineering drawing teaching under the blended teaching model has unique advantages, it also has some shortcomings. Future research needs to explore these deficiencies in depth and seek effective solutions to promote the continuous development and progress of engineering drawing teaching.

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