Transactions on Comparative Education (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/trance.2024.060602
ISSN 2523-5818 Vol. 6 Num. 6

Online and Offline Hybrid Teaching Mode of the Course "Architectural Model Design and Production"

Shengwen Chen

School of Construction, Guangdong Technology College, Zhaoqing, Guangdong, 526100, China
454154834@qq.com

Keywords: "Architectural Model Design and Production" Course, Online and Offline Hybrid Teaching, Project Creativity, Teamwork Ability

Abstract: In view of the problems of disconnection between theory and practice, insufficient student innovation ability and weak teamwork training in traditional architectural model design and production courses, an online and offline hybrid teaching mode is introduced to comprehensively improve students' professional quality and comprehensive ability by integrating theoretical learning and practical training. First, through the analysis of student needs, the teaching objectives are determined and the course structure is constructed. The course content is divided into three modules: theoretical learning, skill training, and creative design application, laying the foundation for the integration of teaching content. Then, the online part sets up video courses, operation guidance and discussion areas, covering the basic concepts of model design, tool operation and case analysis, providing students with independent learning resources; the offline part focuses on group training and practical operation. Students are divided into groups to design and make models, and complete the whole process from conception to finished product under the guidance of teachers. Finally, through the seamless connection between online tests and offline training, a closed-loop feedback mechanism is formed. The offline teaching content is adjusted every week according to the online test results, and the students' learning progress is continuously evaluated through phased project assessments to ensure the in-depth integration of theory and practice. Compared with the traditional teaching mode, students in the hybrid teaching group performed better in the final test, project creativity score and teamwork score. The average score of the hybrid teaching group in the division of labor clarity was 8.8, while the average score of the traditional teaching group was only 6.4. This paper provides a new teaching path for future architectural education, and also provides a teaching model that can be used as a reference for other practical courses.

1. Introduction

Against the background of rapid development of information technology, digital technologies such as Computer-Aided Design (CAD), virtual reality and 3D printing are gradually introduced into architectural model design courses. However, traditional teaching methods still have the problem of separation between theory and practice and insufficient cultivation of students'

innovative ability. During the learning process, students often find it difficult to apply theoretical knowledge to model making practice, resulting in incomplete knowledge and unskilled operation skills. In addition, the architectural model design and production course is highly comprehensive and practical, and places high demands on students' teamwork and innovative thinking. Many studies have shown that the traditional single teaching model can no longer meet the needs of contemporary higher education for cultivating innovative talents. In recent years, hybrid teaching has been gradually promoted in various courses, especially in disciplines that emphasize both theory and practice. However, in the course of architectural model design, how to systematically integrate online resources and offline practice to effectively improve students' innovation and practical ability is still lacking in systematic empirical research. Therefore, this study introduces an online and offline hybrid teaching mode in order to achieve a deep integration of theory and practice, improve students' comprehensive abilities, and provide new ideas for the teaching innovation of this course.

In response to the above problems, this paper mainly focuses on the application of hybrid teaching mode in the architectural model design course. Although previous studies have achieved preliminary results in the exploration of hybrid teaching mode, there are still many challenges in the specific teaching scenarios of architectural design and model making. For example, how to use online resources to systematically train students in model design skills, how to effectively design offline training sessions to consolidate students' theoretical knowledge, and how to evaluate students' innovation and teamwork abilities in actual operations. Based on these challenges and gaps, this article takes the architectural model design and production course as a case study to explore the applicability of the hybrid teaching model in this field. The motivation of the study is to break the limitations of traditional teaching by integrating the advantages of online and offline teaching, help students master the core knowledge and skills of architectural model making more comprehensively, and inspire them to incorporate more innovative and personalized elements into the design process.

The research framework of this paper is divided into three parts. First, in the teaching model analysis part, through the investigation of student needs and the decomposition of teaching objectives, a teaching model framework oriented towards the combination of theory and practice was constructed, providing a structured basis for course design. Then, in the integration and implementation of teaching content, the design and configuration of online and offline teaching resources were introduced in detail. The online module covers the theoretical knowledge and operation process of model making, while the offline module helps students master the actual operation of model making through practical training activities. Finally, in the teaching effect evaluation part, the application effect of the hybrid teaching model was verified through final tests, innovative design projects and group cooperation scoring, and improvement suggestions were put forward based on student feedback. This research process not only ensures the close connection between theory and practice, but also achieves positive results in actual teaching, laying a theoretical and practical foundation for further promoting the application of hybrid teaching mode in architectural model design courses.

2. Related Work

In the teaching of architectural model design, the application of digital means has gradually increased, including the introduction of technologies such as computer-aided design and 3D printing, which enables students to present design details more accurately in model making and improves the interactivity of classroom teaching. Si et al. [1] analyzed the current status of the teaching mode of the "Model Making and Expression" course, explained the reasons for carrying out teaching reform in the architectural model course, and initially explored the formation of a new

teaching mode that combines competition with the architectural "Model Making and Expression" course by promoting learning and teaching through competition. They took the 4th Zhejiang University Student Clothing and Apparel Creative Design Competition as an example to conduct teaching practice and provide reference for the innovation of the teaching mode of the "Model Making and Expression" course. Sa et al. [2] conducted a study on the teaching of basic architectural design courses based on the idea of architectural heritage protection. Yang et al. [3] took the architectural model experiment teaching reform as an example to carry out innovative teaching, and believed that experimental practice teaching is a key link in the process of cultivating high-level and innovative talents in contemporary times. Through effective reform plans, the traditional teaching model is adjusted, the content of experimental projects is optimized, and students' professional interests and independent innovation capabilities are stimulated, so that innovative practice education in colleges and universities can better serve social and economic development. Ibrahim et al.[4] studied the online teaching evaluation case of architectural design and basic design courses at the School of Architecture of Jordan University of Science and Technology. Asadpour[5] believed that teaching online architectural design courses in Iran during the COVID-19 pandemic was a great challenge for students. However, existing studies have mostly focused on a single technical means and lacked exploration of systematic teaching models, especially in terms of how to organically combine theoretical learning with practical operations. This limits students' independent design and practical ability in complex projects.

In addition, many studies have confirmed that the hybrid teaching model has a significant effect in improving students' independent learning and innovation capabilities, especially in information technology and design courses. The hybrid teaching model enhances students' learning experience by combining free learning of online resources with offline hands-on practice. Chan et al. [6] explored the application of immersive virtual reality in remote teaching of architectural history. Varma & Jafri [7] explored the impact of COVID-19 on responsive teaching of undergraduate architecture in India from the perspective of post-epidemic education. Seyman & Kismet [8] explored the applicability of digital models based on augmented reality in architectural construction education. Javohir et al.[9] argue that architectural education is a key component in shaping the future of the built environment. As the field continues to evolve, it is critical to explore innovative approaches to teaching architectural science. They explored the challenges facing architectural education and proposed strategies to enhance the teaching experience. Wang[10] explored a comprehensive evaluation system for teaching quality based on a big data architecture. However, in the course of architectural model design, how to optimize the connection between online and offline teaching content to ensure that students can obtain a deeper practical experience still lacks in-depth empirical research and applicability evaluation.

3. Methods

In order to improve the teaching effect of the architectural model design course, this paper designs a new teaching process and strategy based on the online and offline hybrid teaching mode, aiming to better realize the combination of theory and practice [11-12]. The specific implementation process is divided into three parts: teaching mode analysis, integration of online and offline teaching content, and teaching effect verification.

3.1 Teaching Mode

The analysis of teaching mode is the core part of this paper's method, which aims to build a hybrid teaching mode that can effectively integrate theory and practice and provide a complete architectural model making skill training system.

3.1.1 Student needs

In order to ensure the practicality and pertinence of the course, the paper first conducted a survey on students' learning needs. The survey content included the mastery of basic model design skills, the use of computer-aided design software, and the acceptance of online course content. The results showed that most students hope to learn the operation process of design software through online platforms and apply the learned skills to practical projects. Therefore, the course design needs to focus on practicality in content, and the course structure should ensure a smooth connection between theoretical learning and practical operation.

3.1.2 Decomposition of teaching objectives

Based on student needs, the teaching objectives of the course are divided into three main parts: basic theory learning, skill operation training, and creative design application. The theoretical learning part focuses on explaining the principles, methods and design process of architectural model design; skill operation training aims to help students master the use of modeling tools through practical projects; creative design application requires students to carry out personalized design on the basis of completing the course. This goal decomposition process provides a clear implementation direction for the hybrid teaching model, and this structured design model can improve the teaching effect.

The formula used to calculate the average score of each scoring indicator (such as knowledge mastery, innovation ability, and teamwork ability) under the hybrid teaching model is as follows:

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i \tag{1}$$

Among them, $\bar{X}$ is the average score, n is the number of students, and X_i is the score of the ith student. Through this formula, the level of overall teaching effect can be analyzed.

3.2 Integration of Online and Offline Teaching Content

The core of the hybrid teaching model is to effectively integrate online and offline teaching content so that students can systematically learn architectural model design knowledge and accumulate practical experience. This section can introduce the specific teaching steps and technical details in detail.

3.2.1 Design and configuration of online teaching resources

Online teaching content includes modules such as the basic concepts of architectural model design, design tool operation process, and design case analysis. It mainly provides video courses and electronic teaching materials through the MOOC platform [13]. First, to ensure that the teaching resources meet the course requirements, the teaching team produced a series of video courses covering all aspects of architectural model making, such as design concept explanations, common tool introductions, software operation guidance, etc. Secondly, a discussion area and homework submission system were set up through the teaching platform, so that students can interact with teachers online and provide timely feedback on problems encountered during the learning process. The design of this part of online teaching ensures that students can learn basic skills independently outside of class and prepare for subsequent offline practice.

3.2.2 Implementation and supervision of offline training

The offline teaching part is mainly based on practical operation, and provides a variety of model

making materials and equipment. First, the teacher demonstrated the process of making the architectural model in the classroom, and explained in detail the selection and use of tools and materials. Afterwards, the students were divided into groups, assigned design themes, and completed the model making under the guidance of the teacher. During the offline training, the teaching team strictly supervised the students' operating specifications to ensure safety and quality. In addition, periodic inspections and feedback are arranged during the teaching process. Teachers score and comment on the models completed by students, so that students can continuously improve their model-making ability in the process of practice.

3.2.3 Design of the connection between online and offline content

In order to achieve seamless connection between online and offline teaching content, the teaching team carefully designed the connection points of each link. Specifically, after the online teaching content is completed each week, students need to complete an online test to test their mastery of theoretical knowledge and record it on the teaching platform as the basis for offline training. In addition, at the beginning of the offline course, the teacher can focus on explaining the results of the online test to help students consolidate theoretical knowledge and improve their application ability. This integration of online and offline content not only improves the coherence of the course, but also promotes students' internalization of knowledge.

The following formula is used to evaluate the difference in the effectiveness of online and offline teaching, and analyze the impact of hybrid teaching by calculating the difference in the average scores of the two groups:

$$D = \bar{X}_{\text{blended}} - \bar{X}_{\text{traditional}} \tag{2}$$

Among them, D is the difference in scores between the two teaching modes, $\bar{X}_{\text{blended}}$ is the average score of the hybrid teaching group, and $\bar{X}_{\text{traditional}}$ is the average score of the traditional teaching group. This formula helps to quantify the improvement of hybrid teaching over traditional teaching.

3.3 Teaching Effect Verification

After completing the teaching mode analysis and content integration, this paper can verify the effectiveness of the model through teaching practice. The verification process is divided into three parts: teaching effect data collection, student feedback analysis and teaching effect improvement.

3.3.1 Teaching effect data collection

In order to scientifically evaluate the teaching effect, this paper adopts a variety of methods including classroom observation, student questionnaire survey and test score analysis to collect data. First, the teacher observes and records the students' performance in class, especially focusing on the students' operational proficiency, teamwork and completion quality in practical training. Secondly, the paper collected students’ feedback on online and offline hybrid teaching through questionnaire surveys to understand their evaluation of course content, teaching methods, and learning gains. Through quantitative analysis of data, it can objectively reflect students’ knowledge mastery in the hybrid teaching mode. The final examination is shown in Figure 1.

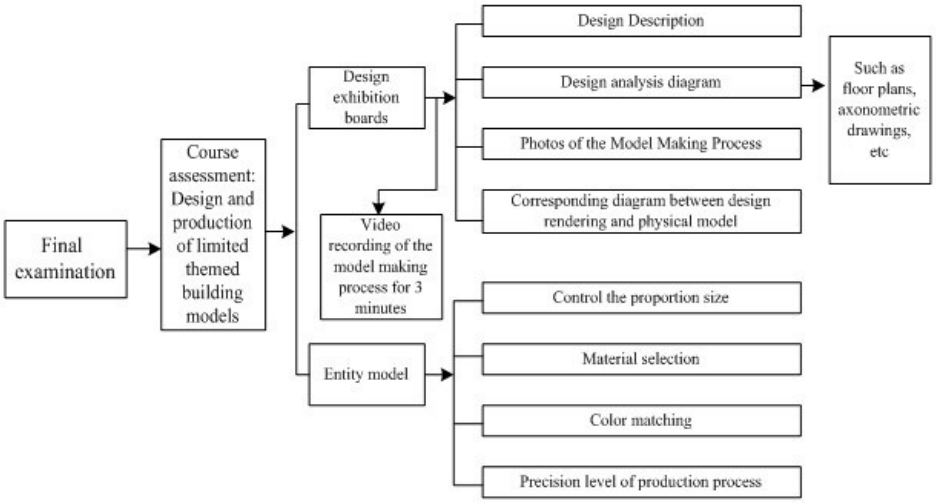

Figure 1: Final exam

3.3.2 Student feedback analysis

Student feedback analysis is a key link in evaluating teaching effectiveness, aiming to further optimize the hybrid teaching model. Student feedback mainly includes the acceptance of online teaching content, the effectiveness of offline operation guidance, and the overall satisfaction with the teaching method. In the feedback, most students said that online courses helped them master basic skills, while offline training provided valuable practical opportunities. In addition, some students expressed the hope to increase the opportunities for more self-selected projects, so as to improve their enthusiasm and participation in learning. Based on the feedback from students, this paper believes that the current teaching model has a high degree of recognition, but there is still room for improvement in course design, especially in increasing the flexibility of the course.

3.3.3 Measures to improve teaching effectiveness

Based on the teaching effect data and student feedback results, this paper proposes a series of improvement measures. First, in order to further enhance students' understanding of the course content, teachers plan to optimize the chapter design of online video courses and refine the knowledge points so that students can better master the key points of operation. Secondly, in the practical training session (spatial cognition physical model design and production training, indoor or outdoor model design drawing conversion, indoor or outdoor model production), teachers can introduce more innovative projects to stimulate students' creativity. In addition, it is planned to introduce an online group discussion and Q&A platform so that students can share their production experience and skills online and improve the interactivity of online and offline teaching. These improvement measures are aimed at further improving the effect of hybrid teaching and making it better adapt to the needs of architectural model design courses.

4. Results and Discussion

In order to comprehensively evaluate the application effect of online and offline hybrid teaching mode in architectural model design courses, this study tested its actual performance in terms of students' knowledge mastery, innovation ability cultivation and team collaboration improvement through three experiments. The experiment uses a combination of quantitative and qualitative methods to analyze the impact of different teaching methods on students' skills and abilities.

4.1 Experimental Environment and Parameter Settings

The experiment was carried out in the architectural model design course, involving two classes of third-year architecture and environmental design majors. The course content includes theoretical learning of model making, practical training, and innovative design projects. All experiments were conducted in a training room equipped with complete hardware facilities (such as 3D printers, engraving machines, electrostatic flocking machines, etc.). Students used design software such as AutoCAD, SketchUp and 3ds Max to complete model making. The online part of the course relies on the MOOC platform to provide teaching videos, case analysis and online tests. The experimental indicators are divided into three categories: knowledge mastery, innovation ability and teamwork ability.

4.2 Result Analysis

(1) The impact of online and offline teaching on knowledge mastery

Experimental purpose: This experiment aims to verify whether the combination of online and offline teaching can significantly improve students' mastery of architectural model design theory and skills. Experimental method: Two groups of students were selected, one group adopted the traditional offline teaching mode, and the other group adopted the online and offline hybrid teaching mode, with the same teaching content and class schedule. The students' knowledge mastery is evaluated through the final test and model making assessment. The final test focuses on the mastery of theoretical knowledge, while the model making assessment tests the operational skills. The evaluation results of the impact of online and offline teaching on knowledge mastery are shown in Figure 2.

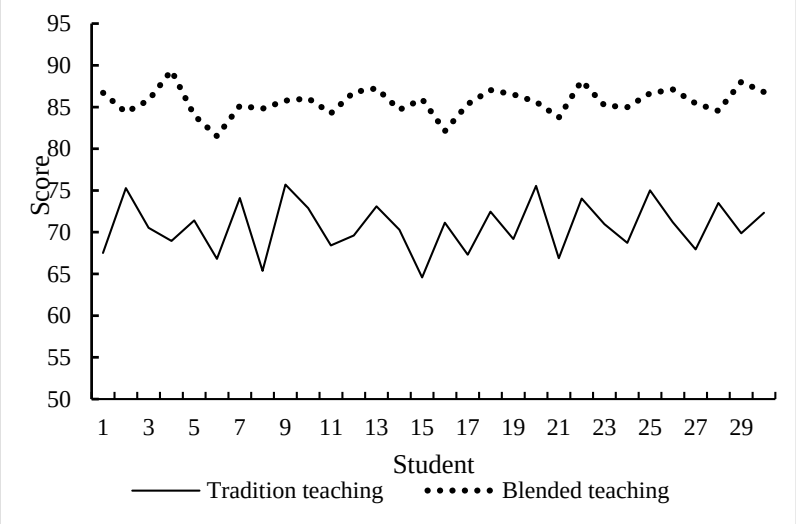

Figure 2: Evaluation results of the impact of online and offline teaching on knowledge mastery

When analyzing the above final exam score data, it can first observe that the performance of the two groups of students is significantly different. The score range of the traditional teaching group is relatively concentrated, with an average of about 70, showing a certain stability, but the overall level is relatively low. On the contrary, the average score of the hybrid teaching group reached 85, and the distribution was relatively wide. Many students scored above 80 points, reflecting their advantages in knowledge mastery. Further analysis of the specific scores of each student shows that some students in the mixed teaching group even scored more than 90 points, indicating that some students have made significant progress in the process of combining practice with theory. This not

only demonstrates the effectiveness of the mixed teaching model, but also highlights the importance of individual differences and innovative thinking among students. In summary, these performance data clearly reflect the impact of different teaching models on students' knowledge mastery, and provide an important reference for future teaching design and method selection. Through such analysis, it can better understand how to optimize teaching strategies to improve students' overall learning outcomes.

(2) The effect of innovative design projects on cultivating students' innovative ability

Purpose of the experiment: To verify whether the hybrid teaching model can effectively stimulate students' innovative thinking and improve students' ability to express creativity and personalization in model design. Experimental method: Students participated in the innovative design project in groups, and the topic was chosen by the students themselves to demonstrate their creative thinking. After the project was completed, industry experts and teachers were invited to score and evaluate the design based on its originality, functionality and feasibility. In addition, students were required to submit a project report to explain the innovative thinking and design logic in the design process. The effect of the innovative design project on cultivating students' innovative ability is shown in Figure 3.

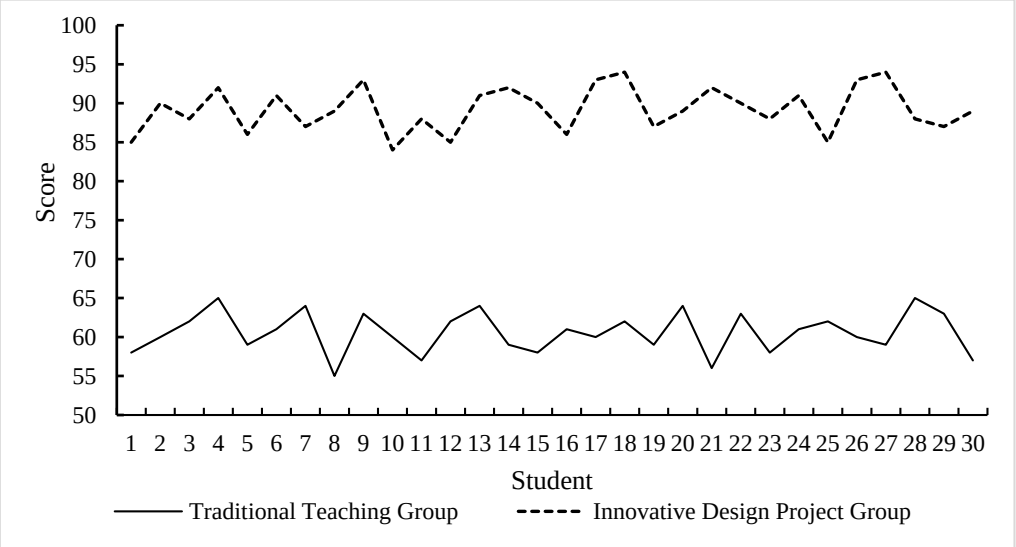

Figure 3: The effect of innovative design projects on cultivating students' innovative ability

The above innovative ability evaluation data can be analyzed to clearly show the significant difference in innovative ability between the two groups of students. The scores of the traditional teaching group are generally low, and the scores of all 30 students are concentrated between 55 and 65, with an average of about 60. This shows that the traditional teaching model may have certain limitations in stimulating students' innovative thinking and ability, and students are not active and creative enough when participating in innovative activities. In contrast, the scores of the innovative design project group were generally higher, ranging from 84 to 94, with an average of about 89. This result shows that the innovative design project has a significant effect on improving students' innovative ability. Many students in this group scored more than 90, indicating that some students showed strong creativity and practical ability in the project, which is closely related to the practical orientation and interactive learning characteristics of the project. Judging from the standard deviation of the scores, the traditional teaching group's scores fluctuated less, reflecting the consistency of students' innovative ability, but the overall level was low. The scores of the innovative design project group fluctuated more, which may be related to the differences in each student's participation, interest, and creativity in the project. This fluctuation shows that although

most students benefited from the project, some individual students may not have fully realized their potential during the participation process. Through such analysis, the data not only shows the impact of different teaching methods on students' innovative ability, but also provides a basis for future teaching design. Introducing more practical and creative projects can help improve students' comprehensive abilities and lay a good foundation for their future learning and career development.

(3) The effect of group projects on improving teamwork ability

The purpose of the experiment is to evaluate the effect of the hybrid teaching model in teamwork training, focusing on the students' communication, collaboration and division of labor in team tasks. The experimental method is to arrange a group model design project in the later stage of teaching, requiring students to complete the division of labor, design, production and display within a specified time. After the project is completed, each team member can evaluate each other, and the teacher can score the team's completion quality, rationality of division of labor, and collaboration efficiency. Teamwork scores include clarity of division of labor (40%), collaboration efficiency (30%), and communication skills (30%). This article selects serial numbers 1-5 and 11-15, and the effect of group projects on improving teamwork ability is shown in Table 1.

Table 1: Effect of group projects on improving teamwork ability

Student ID	Teaching Group	Clear division of labor (out of 10)	Collaboration efficiency (out of 10)	Communication skills (out of 10)	Total score (out of 30)
1	Blended learning group	9	8	8	25
2		9	9	9	27
3		10	8	9	27
4		8	7	8	23
5		8	8	9	25
11	Traditional teaching group	6	6	7	19
12		7	5	6	18
13		7	6	7	20
14		6	7	5	18
15		6	5	6	17

In this experiment, this paper quantitatively evaluated the teamwork ability of the hybrid teaching group and the traditional teaching group. The results in the data table clearly reveal the differences in the two groups of students in terms of division of labor clarity, collaboration efficiency, and communication skills. First, the average score of the hybrid teaching group in division of labor clarity was 8.8, which shows that the students were able to effectively understand their respective roles and responsibilities and ensure the smooth progress of the task. This clear division of labor not only improves work efficiency, but also enhances the overall coordination of the team. In contrast, the average score of the traditional teaching group was only 6.4, reflecting their shortcomings in task allocation, which caused some students to feel confused when completing tasks, thus affecting the team's collaborative effect. Secondly, in terms of collaboration efficiency, the average score of the hybrid teaching group was 8.0, indicating that students were able to collaborate efficiently to complete the project, thanks to the combination of online discussion and offline practice, which enabled team members to provide timely feedback and adjust work progress. However, the average score of the traditional teaching group was 5.8, indicating that they had obvious coordination problems during the collaboration process, probably due to the lack of effective communication and timely interaction. Finally, communication skills are a crucial part of teamwork. The average score of the hybrid teaching group was 8.6, indicating that they performed well in information exchange and feedback, and were able to make full use of online platforms for communication, while the average score of the traditional teaching group was 6.2, reflecting the

existence of communication barriers, which hindered the flow of information between team members. This inefficient communication may lead to misunderstandings and task delays, which in turn affects the overall work progress of the team. In summary, the hybrid teaching model significantly improved students' teamwork ability. These results not only provide empirical evidence for further optimizing teaching methods, but also point out the direction for better cultivating students' teamwork ability in educational practice.

4.3 Discussions

In summary, through the three experiments, it can be seen that the application effect of online and offline hybrid teaching mode in architectural model design courses is significant. Knowledge mastery: Students have improved in both theoretical knowledge and practical operation, especially in the final test and actual operation. Online learning resources lay a solid theoretical foundation for students, while offline practice strengthens practical operation skills. Innovation ability: The hybrid model provides students with richer learning resources, stimulates students' creative expression ability, and makes them more outstanding in innovative design. Through flexible course settings, students have the opportunity to explore diverse expressions in personalized design.

Teamwork ability: The combination of online and offline teaching provides an efficient communication platform for students' team projects. Students show higher cooperation and coordination ability in team tasks, which effectively improves the effectiveness of teamwork. The results of this experiment show that the hybrid teaching model in the architectural model design course not only enhances students' knowledge mastery and innovation ability, but also significantly improves the effect of teamwork. Compared with the traditional teaching model, the hybrid model provides students with more resources and practical opportunities, and promotes the seamless connection between theory and practice. Future research can further optimize the teaching process, explore more ways to stimulate students' active learning and innovation potential, make the teaching content more in line with industry needs, and provide stronger support for students' career development.

5. Conclusions

This study has made several key findings through an in-depth discussion of the application of hybrid teaching mode in the architectural model design and production course. First, the study shows that the hybrid teaching model significantly improves students' knowledge mastery, innovation ability and teamwork ability. This innovative result not only provides a new perspective in the field of education, but also enriches the theory and practice on how to effectively integrate online and offline learning. In terms of practical application, the research results have broad potential value. First, in architectural education, the use of hybrid teaching can effectively improve students' learning outcomes and provide educators with a reference for teaching design ideas. Second, this model can also be extended to other disciplines, especially those courses that require practice and teamwork, thereby promoting the improvement of overall teaching quality. In addition, the research results also provide empirical support for the formulation of educational policies, emphasizing the importance of diversified teaching methods in cultivating students' abilities. Finally, in summary, this study not only demonstrates the unique value of hybrid teaching in improving students' comprehensive quality, but also provides a theoretical basis and practical guidance for the future curriculum design and implementation in architectural education and other related fields. This research result provides a new direction for educational reform and innovation, and helps to promote the continuous improvement of education quality.

Acknowledgements

2024 Annual School-level First-class Course Cultivation Project: "Architectural Model Design and Fabrication" (Project Number: YLKCPY202434)

References

[1] Si Duo, Zhang Jin, Wei Rui, et al. Promoting learning through competition: On the cultivation of architectural model making and performance ability from the perspective of subject competition [J]. Teaching Method Innovation and Practice, 2021, 4(10): 119-122.
[2] Sa Ying, Wang Xiaoyun, Li Zhiying, et al. Teaching of basic architectural design courses based on the idea of architectural heritage protection [J]. Higher Architectural Education, 2021, 30(4): 101-108.
[3] Yang Lili, Hua Guanqing, Huang Haijing. Innovative reform of university design experimental courses based on the OBE concept: Taking the teaching reform of architectural model experiments as an example [J]. Higher Architectural Education, 2023, 32(4): 95-102.
[4] Ibrahim A F, Attia A S, Asma'M B, et al. Evaluation of the online teaching of architectural design and basic design courses case study: College of Architecture at JUST, Jordan[J]. Ain Shams Engineering Journal, 2021, 12(2): 2345-2353.
[5] Asadpour A. Student challenges in online architectural design courses in Iran during the COVID-19 pandemic[J]. E-learning and Digital Media, 2021, 18(6): 511-529.
[6] Chan C S, Bogdanovic J, Kalivarapu V. Applying immersive virtual reality for remote teaching architectural history[J]. Education and Information Technologies, 2022, 27(3): 4365-4397.
[7] Varma A, Jafri M S. COVID-19 responsive teaching of undergraduate architecture programs in India: learnings for post-pandemic education[J]. Archnet-IJAR: International Journal of Architectural Research, 2020, 15(1): 189-202.
[8] Seyman Guray T, Kismet B. Applicability of a digitalization model based on augmented reality for building construction education in architecture[J]. Construction Innovation, 2023, 23(1): 193-212.
[9] Javohir S, Omina K, Gulnoz X, et al. Enhancing Architectural Education: Innovative Approaches in Teaching Architectural Sciences[J]. HOLDERS OF REASON, 2024, 4(1): 90-94.
[10] Wang Y. A comprehensive evaluation system of teaching quality based on big data architecture[J]. International Journal of Continuing Engineering Education and Life Long Learning, 2020, 30(2): 176-189.
[11] Mamajonova N, Oydin M, Usmonali T, et al. The Role of Computer Graphics in the Teaching of Architecture and Construction Drawing[J]. HOLDERS OF REASON, 2024, 2(1): 359-368.
[12] Matusik A. Role of teamwork formulas in educating Bachelor of Science graduates in architecture[J]. World Transactions on Engineering and Technology Education, 2020, 18(3): 324-329.
[13] Glinsky J V, Ilha J, Xiong, Yuan Gomez, Guillermo Rostagnor, StephanMartin-Manjarres, SorayaTranter, KeiraMuldoon, StephenWeerts, EricHarvey, Lisa A.The 2022 Massive Open Online Course (MOOC) to train physiotherapists in the management of people with spinal cord injuries: a qualitative and quantitative analysis of learners' experiences and its impact[J].Spinal cord: the official journal of the International Medical Society of Paraplegia, 2023, 61(11):615-623.