

Blended Learning Design and Practice for the Principles of Communication Course

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Abstract: With the rapid development of information technology and the continuous innovation of educational concepts, blended online and offline teaching has become a major trend in the field of higher education. This article focuses on “Principles of Communication”. A core engineering course, and explores how to effectively enhance students' learning outcomes and practical abilities through blended learning in the new era. By analyzing the characteristics, design principles, implementation strategies, and effectiveness evaluation of the blended learning, it aims to provide new ideas and practical references for teaching reform in the principles of communication course. Course diagnostics and surveys indicate that students have given excellent evaluations to the course and their skill development, with positive feedback on the teaching. Students have also shown significant improvement in their learning autonomy and overall abilities. Therefore, adopting a blended learning model combining online and offline instruction can enhance teaching effectiveness and improve the quality of talent cultivation.

Keywords: Principles of Communication, Blended Learning, Teaching Mode, Instructional Design

1. Introduction

In recent years, with the rise of MOOCs, blended learning models have taken on new meaning. Combining online learning with offline discussions, students first learn basic knowledge online through pre-recorded or assigned video materials, then engage in in-class discussions with the teacher to address unclear or confusing issues, aiming to maximize learning effectiveness[1]. The basic idea is. Blended learning is the integration and complementarity of online learning and

traditional classroom teaching, bringing out the best in both the teacher's guiding role and the student's active participation, thus achieving better teaching results.

“Principles of Communication” a compulsory course for majors in electronic information, communication engineering, and other related fields, covers fundamental theories and key technologies such as signal and system, modulation and demodulation, channel coding, multiplexing and switching[2]. This course is highly theoretical and abstract, and traditional lecture-based teaching often fails to spark students' interest and deep understanding[3]. Therefore, introducing a blended learning model aims to leverage the advantages of information technology, break down time and space constraints, enhance teacher-student interaction, and improve learning efficiency.

2. Blended Learning Objectives Design for the Principles of Communication

The design of “Principles of Communication” course learning objectives is centered around reforming and improving an interactive learning system that combines online and offline aspects, with a focus on “teacher-led, student-centered, textbook-based, supported by modern information technology, and aimed at enhancing students' comprehensive application abilities.” This reform aims to improve a three-dimensional learning environment that consists of “classroom teaching as the primary method, supplemented by multimedia presentations, online courses, personalized independent learning, and extracurricular activities for comprehensive quality practice,” as well as to perfect a “dual teaching evaluation system for both teachers and students,” to promote overall improvement in classroom teaching quality. The learning objectives are designed according to the following principles:

(1) Clarity of Objectives: Clearly define the teaching objectives for each online and offline stage, including knowledge, skills, qualities, and educational objectives, ensuring the coherence and systematic nature of the overall curriculum.

(2) Content Complementarity: Utilize online platforms for knowledge point learning, and offline classes for in-depth explanation and interaction, achieving a blended learning approach. The online component focuses on basic knowledge explanation, case analysis, video tutorials, etc., while offline learning emphasizes practical operations, group discussions, problem-solving, etc., forming a complementary relationship.

(3) Effective Interaction: Utilize online platforms for assignment submission, online tests, and discussion forum interaction, enhancing teacher-student interaction and student collaboration.

(4) Diverse Evaluation: Combine formative and summative evaluation, including online learning data, offline classroom performance, project assignments, practical operations, etc., for a multi-dimensional assessment[4].

3. Teaching Organization Form

The “Principles of Communication” course emphasizes student-centered learning in each teaching stage, adapting to individual student needs, focusing on both teaching and learning, where learning is promoted through various teaching activities[5]. The blended learning organization form is primarily divided into three stages: pre-class, in-class, and post-class[6], as shown in Figure 1.

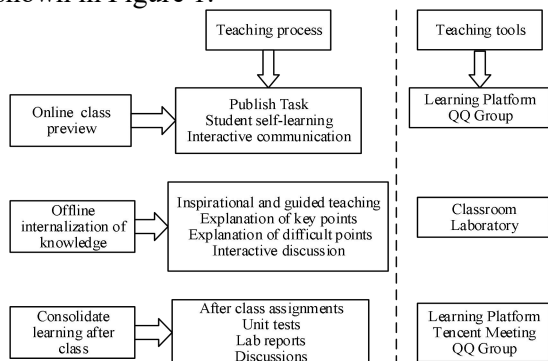


Figure 1. Teaching Organization Form

(1) Pre-Class (Online): Teachers use online platforms to publish preview assignments, and students can access them through learning platforms and QQ groups, allowing for targeted pre-study of specialized courses. They can self-

study teaching videos or basic content from lesson plans. Teachers can track students' pre-class learning progress online, identifying areas where students struggle or have frequent questions in the discussion forum, thus prioritizing those topics in subsequent classroom teaching.

(2) In-Class (Offline): In the blended learning model, offline classroom teaching is the most crucial component. Teachers guide students to learn deeply from three levels: knowledge, skills, and emotions. Based on students' online pre-study, the teacher emphasizes key points, delves into challenging and error-prone areas, and incorporates group discussion sessions to encourage student initiative. Besides addressing theoretical knowledge, teachers should also focus on cultivating students' practical and applied skills.

(3) Post-Class (Online + Offline): Students complete offline assignments and online unit tests according to requirements, while teachers review and evaluate their performance, marking student work and assessing learning outcomes. Students can also interact with teachers in real-time through the internet, boosting their learning motivation and achieving better teaching results. During this stage, students complete summaries and enhancements, while teachers reflect on their teaching.

Under the blended learning model, course evaluation standards should be flexible, reflecting the diversity and process-oriented nature of the evaluation system[7]. The evaluation system for the “Principles of Communication” course is adjusted into three main parts: online learning performance accounts for 30% (including chapter learning (30%), chapter tests (20%), classroom activities (10%), discussions (10%), and assignments (30%)); classroom performance accounts for 30% (including attendance (30%), classroom discussions (20%), and experimental sessions (50%)); and the final exam accounts for 40%. This allows for a more balanced reflection of different students' participation and motivation throughout the learning process.

4. Teaching Design and Practice

Taking the lesson "Channel Capacity" in Chapter 4 of Communication Principles as an example, this section introduces a blended teaching design plan.

4.1 Teacher Guidance, Student Independent Pre-study

Use a problem-based approach to spark students' interest in the lesson's content[8]. Start by asking students: why do we need to study communication channel capacity? Then, explain the technological background behind the problem and the significance of studying channel capacity. Guide students to think about several critical technical issues: (1) Why do communication channels have capacity (the quantitative analysis of channel capacity)? (2) How do we determine the size of channel capacity (the qualitative analysis of channel capacity)? (3) What are the implications of channel capacity?

Students can then engage in independent learning, using online platforms to preview the knowledge covered in this lesson, or by consulting relevant books and materials.

4.2 Classroom Lecture and Discussion

Begin the class by having students answer the three questions posed by the teacher. The teacher summarizes based on their responses.

Next, proceed to derive the formula for continuous channel capacity, also known as the Shannon formula, and explain its three elements. Here, an example can be used: think of a city's roads and the cars on them; what does the speed of the cars (data rate) depend on? Similar to the impact on driving speed, besides the car's own power, it is primarily limited by the width of the road (bandwidth) and other factors such as the density of traffic and the frequency of traffic lights (signal-to-noise ratio). At this point, ask the students: what impact does increasing channel bandwidth infinitely have on channel capacity? Have students work in groups to discuss. Each group sends a representative to answer the teacher's question, and if the response is inaccurate, other group members can stand up and supplement. In the teaching process, uphold the principle of "student-centered" [9], encouraging student participation, emphasizing teacher-student interaction, creating a lively classroom atmosphere, and effectively reinforcing the teaching results. The teacher summarizes based on the students' discussion and derives the conclusions.

While teaching theoretical knowledge, emphasize the application of natural science methodology in Shannon's theorem and the philosophical ideas it embodies. For example,

Shannon's theorem is based on the objective laws of the material world. It reveals the relationship between matter and energy during information transmission, reflecting a materialist philosophical approach. Furthermore, Shannon's theorem contains dialectical thinking. On the one hand, it highlights the positive correlation between information transmission rate and channel bandwidth and signal power. On the other hand, it reveals the limiting effect of noise on information transmission rate. This method of analysis, which sees both positive and negative factors, reflects the comprehensiveness of dialectics.

4.3 Post-class Consolidation

After class, the teacher assigns relevant homework and requires students to complete course quizzes on Learning Through. The pre-class and post-class self-evaluation stages (homework, unit quizzes) enhance learning self-discipline and focus, helping students identify gaps and better understand their learning levels. Students engage in peer-reviewing homework, inter-group reviews, and other multiple scoring methods, facilitating exchange among students, enabling them to learn from each other's strengths and weaknesses, and progress together. The teacher, based on student homework and test performance, offers insights and reflections on teaching and practice, and further expands on teaching.

5. Teaching Effectiveness

5.1 Student Course Evaluation

The course team conducted a pilot teaching reform program for communication engineering students (class of 2021). In terms of learning methods, the online-offline blended model achieved content visualization, addressed online classroom differences, and enhanced in-person classroom interactivity. In terms of classroom effectiveness, it transformed the previously silent, question-and-answer style of teaching into a dialogue-based, argumentative, and discussion-based class, shifting the focus from passive learning to active learning. In terms of student behavior, learning enthusiasm improved, thinking abilities were enhanced, and independent learning awareness was strengthened. Figure 2 shows the distribution of final exam scores for the traditional teaching class and the blended learning class. It is clear

that student performance has significantly improved after the reform, with both passing rates and excellent rates higher than those in the traditional teaching class, indicating good teaching results.

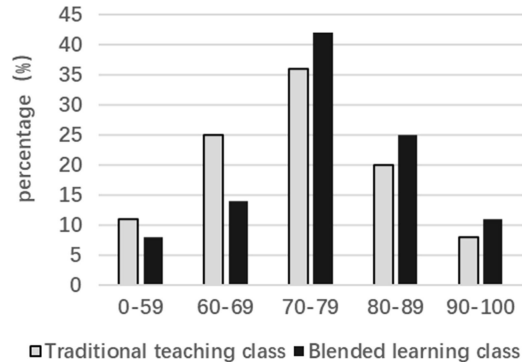


Figure 2. Distribution of Assessment Scores

5.2 Student Satisfaction Survey

Through teacher evaluations conducted for the class using blended learning (communication engineering) and the traditional teaching class (telecommunications engineering)[10], students reported that abundant online course resources met their needs for anytime, anywhere learning; the use of teaching tools like Learning Through made the classroom atmosphere lively, sparking their interest in learning; and practical abilities improved to some extent, which helped students grasp course knowledge. The student evaluation satisfaction scores over the past two semesters are shown in Figure 3. It is evident that the average scores are above 92 points, but the blended learning evaluation scores are significantly higher than the traditional teaching scores, reaching above 93.5 points, indicating that students are generally satisfied with the blended learning model.

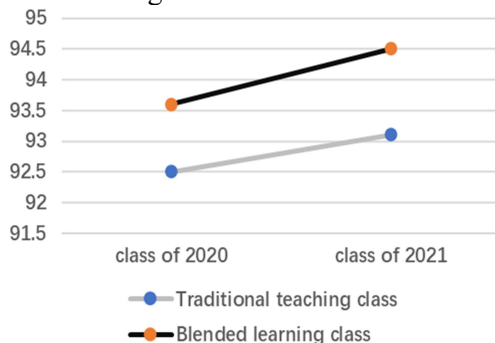


Figure 3. Student Satisfaction with Teaching Evaluation

6. Conclusion

The online-offline blended learning approach for

the “Principles of Communication” course not only overcomes the limitations of traditional teaching but also effectively enhances students’ independent learning abilities, team collaboration skills, and problem-solving abilities. Through carefully designed teaching resources, classroom organization, and practical applications, combined with a scientific evaluation system, the approach can significantly improve teaching quality and learning efficiency, laying a solid foundation for cultivating high-quality talent who can adapt to the future development of communication technology. In the future, with the continuous advancement of educational technology, the application of blended learning in the “Principles of Communication” course will become more widespread and profound.

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