Online and offline blended teaching for a database principles course

Xiaoyan Wang[1,a], Yang Yu [1,b], Yan Dou[1,c]

[1]School of Information Science and Engineering, YanShan University, Qinhuangdao, 066004, China;

[a] wxyhmm@163.com, [b] 190637116@qq.com, [c] douyan@ysu.edu.cn

Abstract. The advantages of traditional offline teaching and emerging online teaching in a database principles course were examined to assess the efficacies of online and offline blended teaching. A three-pronged design strategy—theoretical teaching, practical teaching, and diverse assessment methods—was introduced. Further, to improve the theoretical and practical teaching effects, a combination of online resources, such as Massive Open Online Courses (MOOC), Chaoxing platform, QQ group were utilized with student-centered offline teaching. A total of 130 students from the 2020 Software Engineering major Classes 1–4 in Yanshan University participated in the study. The diverse assessment results showed that compared with the traditional offline teaching control class, the teaching effects of the blended teaching were significantly better.

Keywords: Blended teaching; Database principles; Diversified assessment methods; Teaching effect.

1. Introduction

In the 20th National Congress of the Communist Party of China report, education, science and technology, and talent were deployed as a "trinity" for the first time. "Promoting educational digitization" was included in the report, which clarified the action plans for future educational digitization developments. Because of the rapid developments in big data, artificial intelligence, and other information technologies, the education sector has rapidly entered the "internet plus initiatives" era [1]. Many teaching models that include the internet, like Massive Open Online Courses (MOOC), Small Private Online Courses (SPOC), etc., have emerged. The unexpected COVID-19 pandemic in 2020 promoted the rapid and deep integration of the internet into the education sector with the teaching mode moving from offline teaching to online and offline blended teaching in primary schools, middle schools, and universities.

Blended teaching retains the strong interactive characteristics of offline teaching and the advantages of online teaching such as flexibility, rich resources, and the complete recording of procedural data [2]. While teaching, the teachers adjust the online and offline teaching proportions, design matching teaching links and strategies, and impart knowledge to students from multiple perspectives, which can mobilize learning enthusiasm and ensure student-centered teaching. Therefore, the blended teaching mode has been considered as the "most effective teaching form" [3].

2. Design strategy and practice of blended teaching for the database principles course

Database Principles (DP) is an important basic professional course for software engineering undergraduates at Yanshan University. The course involved 56 teaching hours: 44 teaching hours of theoretical training and 12 teaching hours of practical training. It covers abstract and difficult database principles, SQL language, standardization and practical database design. This course gives students a deep grasp of the working principles of databases, and a preliminary ability to analyze design, develop, and use database systems. Through the study of this course, students can   further deepen the comprehensive understanding and flexible application of the prerequisite courses, and establish a solid foundation for the study of subsequent courses. Blended teaching was applied to

the DP course to improve teaching effectiveness. The design strategy for the DP course is shown in Figure 1, with the online teaching process shown with the dotted lines [4].
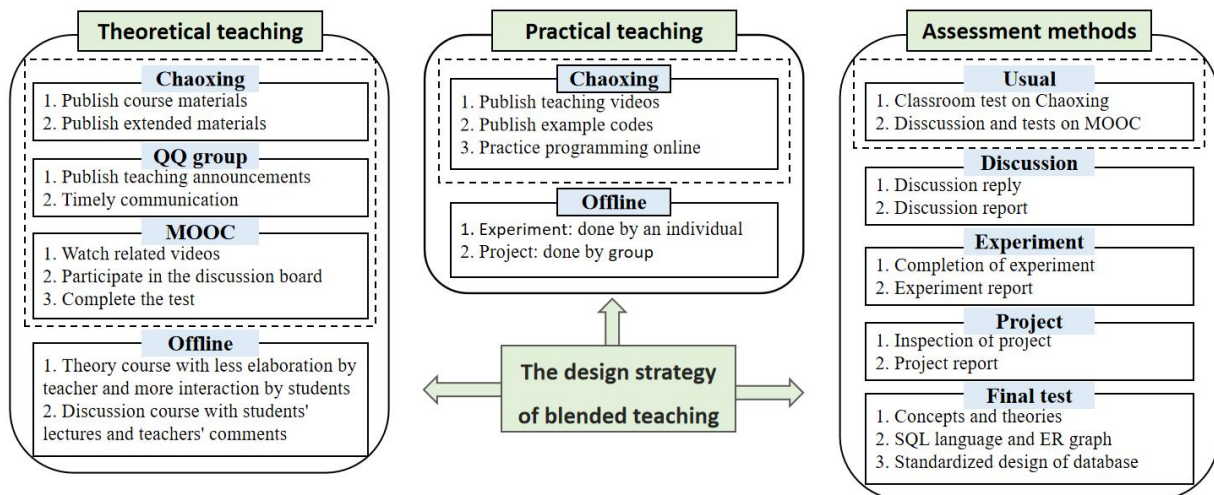

Fig. 1 Database principles blended teaching design strategy

2.1 Theoretical teaching

2.1.1 Online teaching

Online teaching activities are carried out through the combination of Chaoxing platform, QQ course group and MOOC platform.

Chaoxing: Course materials, such as the course outline, teaching calendar, project plan, and course courseware, were released about one week before the class. The courseware helped students preview and clarify the difficult points of the course in advance. Some additional knowledge materials were also uploaded for students interested in learning more.

QQ course group: The instant chat tool, QQ group, allowed convenient and timely student communication. The teaching announcements were seen by students immediately and the teacher-student communication was convenient. The distance between the teachers and students was reduced.

(3) MOOC: At present, MOOC is the largest Chinese platform. An asynchronous SPOC course, which was based on the "Introduction to Database Systems (Basic)" taught by Wang Shan and Du Xiaoyong from Renmin University of China, was opened on the MOOC platform. The total online teaching was 12 teaching hours and comprised six parts: data modeling, database systems, relational models, SQL overview and data definitions, single table and joint queries, and view. Each section included video learning, courseware, discussions, and quizzes. Prior to online learning, the teachers imported the tasks, and then the students learned the online teaching content by watching videos, finding rich online materials, participating in discussions, and completing the quizzes and other activities within a specified time. All online learning data were recorded on the platform as one of the basis for the process assessments.

2.1.2 Offline teaching

There were two theoretical offline teaching modes. One was a theory course that involved less teacher talking and greater student interaction. Instead of using the "full hall" teaching method in the class, offline teaching, which involves both student and teacher participation, was adopted to encourage the students to think positively [5]. The other offline teaching mode was a discussion course that involved student lectures and teacher comments. Groups were formed and leaders were selected, after which students in the collaborated to source relevant literature and prepare presentation materials for the discussion class. During the discussion period, each group had to complete an explanation within a specified time. After the presentation, the teacher asked questions

and promoted exchanges. These teamwork discussion sessions improved students' teamwork and communication abilities and assisted in developing students' potential.

2.2 Practical teaching

2.2.1 Online teaching

The DP course was very practical. Teaching videos, example codes, and different topics were released online through Chaoxing platform. Students could do independent programming exercises to check and fill gaps, and the teachers could improve their practical teaching based on the students' practice results.

2.2.2 Offline teaching

The offline practical teaching involved 12 teaching hours, which included both individual experiments and group projects. The individual experiment was focused on becoming familiar with SQL Server software and using SQL statements.Therefore, students could deepen their understanding of what they had learned and to improve their practical ability. In the group project, each group designed a standard database system through the division of labor, which improved the students' teamwork and communication abilities and cultivated a sense of responsibility.

2.3 Diversified assessment methods

The teaching evaluation comprised multidimensional learning effects. Therefore, the assessment method included process assessments and outcome assessments, online and offline learning assessments, and theoretical and practical learning effects. The students' learning effect was comprehensively evaluated [6, 7]. The assessment was divided into five parts, four of which were worth 10 points each and a final examination of 60 points. The usual assessment, which is one of the most important process evaluation, was based on students' test completion and their discussions on the online platform. The discussion assessment was based on the group discussion reply and individual contributions of each member. The experiment assessment was based on experiment completion and the experiment report. The project assessment was based on the group project and individual contributions of each member. The final examination was an offline examination. The test paper content was comprehensive in which the students' abilities to master the basic database knowledge and apply the theoretical knowledge were evaluated.

3. Analysis of the teaching effect

In this teaching reform study, 2020 Software Engineering majors from Classes 1–4 (130 students) were taken as the experimental blended teaching class, and 2020 Software Engineering majors from Classes 5–7 (96 students) were taken as the traditional offline teaching control class.

3.1 Effectiveness analysis of blended teaching mode

(1) Watching videos. The required MOOC videos were about 4 hours long, and the optional videos were about 6 hours long. Table 1 shows the students' viewing times. Most students only watched the required videos, some watched all the videos, and a few students watched videos for too short a time, all of which reflected their self-discipline and utilization of the teaching resources.

Table 1. Students' video viewing times

Viewing times(hours)	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10
Number of people	1	6	20	22	20	15	11	9	5	5	16

(2) Discussion board. In the discussion board on the Chaoxing and MOOC platforms, the teachers posted topics for discussion that had no fixed answers so that students who had the spare capacity to learn could explore them without any rigid requirements. Between 35%–65% of students submitted the discussion, with the average participation being 49.5%. This indicated that

topic discussion activities better stimulated the students' interests and improved their active learning abilities, which in turn would improve the learning effect.

(3) Test results. There were six tests on the MOOC platform. All 130 students participated in the tests, and the average scores were 9.3, 8.6, 8.9, 9.2, 9, and 9.5 (out of 10). These results showed that the students' use of the online resources had good learning effects and that the teachers were able to assess the students' understanding of the relevant knowledge points, identify problems quickly, and resolve them better.

3.2 Comparative analysis of the test results between the experimental class and the control class

The score distributions of experimental and control class are shown in Table 2. Compared with the control class, the experimental class' results were better by 2.52 points. The average score for the control class was 78 and that for the experimental class was 80.52. Therefore, blended teaching significantly improved the average score.

Table 2. Test result comparisons between the experimental class and control class

	A+、A	B+、B	C+、C	D+、D	F
Control class	16.67%	38.54%	27.08%	12.50%	5.21%
Experimental class	19.23%	40.77%	28.46%	8.46%	3.08

4. Summary

There are complementary advantages to online and offline blended teaching. In this teaching reform study, the DP course used online resources such as MOOC, Chaoxing, and QQ groups to complement offline teaching, which built a lightweight and convenient teaching implementation platform. Most students recognized the benefits of blended teaching. Students were able to break the time and space limitations, make use of all available fragments of time for online learning, learn new knowledge by watching the teaching videos from renowned teachers, learn the difficult points repeatedly, strengthen their understanding of the knowledge, and expand their thinking on the discussion board. Combined with offline teaching, students' autonomous learning abilities and the learning effect were significantly improved.

Acknowledgement

References

[1] Zhang Yan. On the concept and mode of "Internet plus education". China Higher Education Research, 2016 (2): 70-73.

[2] Liu Zhentian, Liu Qiang. How online teaching can help college classroom revolution: understanding large-scale online teaching under epidemic situation. Journal of East China Normal University(Education Sciences), 2020, 38(7): 31-41.

[3] Yang Hongyun, Chen Xuhui, Shu Hang. Exploration and practice of mixed teaching mode based on MOOC: a case study of "mobile application design and development" course. China Education Info, 2019(9): 27-31.

[4] Zou Weiqin, Mao Yuguang. Teaching practice of online and offline mixed database principle course. Computer Education, 2022 (4): 133-137.

[5] Zhou Haifang, Zhou Jingwen, Wu Di, et al. Reserach and practice of active learning model: the perspective of hybrid space. Journal of Higher Education Research, 2019 (3): 97-101.

[6] Guo Yanyan, Lou Lanfang, Bi Yuanwei. Hybrid teaching Reform of Unified Modeling Language UML Course based on "MOOC+SPOC+ Rain Class +QQ course group". Computer Education, 2021 (8): 107-111.

[7] Wang Liufang, Qu Ling. Teaching reconstruction of mixed engineering practice. China University Teaching, 2019 (5): 24-28.