ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

The blended teaching practice in the web development fundamentals course

Changli Feng*, Haiyan Wei, Xueming Bai, Sai Qiao, Xiaorong Zhu, Jing Liu

Department of Information Science and Technology, Taishan University, Tai'an, China
**Corresponding author*

Abstract: *To verify the effect of the blended teaching method in software engineering courses, we selected three classes as the experimental group and three as the control group in the web development foundation course to carry out blended teaching. Among them, the control group adopted the traditional classroom teaching method, and the experimental group adopted the blended teaching method based on classroom teaching, online learning, and interactive teaching software. The analysis of the teaching process data showed that blended teaching could effectively improve students' learning output, increase students' self-motivation and improve students' learning performance.*

Keywords: *blended teaching; traditional teaching; online learning; interactive software*

1. Introduction

Traditional classroom teaching is the most popular and common teaching method in Chinese universities and colleges. The benefit of traditional teaching is that it can provide face-to-face interaction, which can transfer core knowledge to students at the same time, explain difficult points, etc[1].

Blended teaching is considered an innovative concept. It embraces the advantages of traditional teaching and the ICT support learning[2]. It is defined as a combination of two or more methods such as multimedia courses, seminars, e-learning, etc[3]. This kind of teaching is widely recognized as an effective way to improve student learning outcomes, increase student engagement and motivation, and enhance the flexibility and accessibility of education.

The main background of the popularity of blended teaching reform in recent years has been the COVID-19 pandemic, which began in 2020. To reduce the contact, university teaching needs flexible and adaptive education methods that can respond to changing environments and provide high-quality education without the constraints of geographic location or physical classrooms. As a result, blended teaching courses have been appearing in more and more universities[4,5].

The traditional computer university education in China is based on classroom teaching, where instructors pass on knowledge and experience to students through lectures and assess their learning effectiveness through exams at the end of the period. However, this approach cannot adapt to the modern level of technological development and industry requirements for students' computer skills, and there are various drawbacks in practice[6].

With the development of technology level, IT-related industries have become the driving force of innovation as well as the main force of technological development in China, and they have put forward higher requirements for the education of related computer talents. In response, many universities are incorporating more interactive courses and project-based learning activities into the computer science curriculum. In addition, more new technologies and tools will be incorporated. For example, online learning, artificial intelligence, etc.

In summary, while traditional classroom education remains an important means of computing education, increasingly more innovative and student-centered approaches will be adopted to enhance student's knowledge and develop practical skills.

To introduce more online resources and mobilize students to engage in learning more flexibly in the Web Development Fundamentals course, we constructed a blended classroom course through online platforms, cross-platform applications, and traditional instruction. The purpose of this study is to evaluate whether blended instruction is more capable of improving student learning outcomes by analyzing data on various aspects of student performance.

ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

2. Methodology

2.1. Research Design

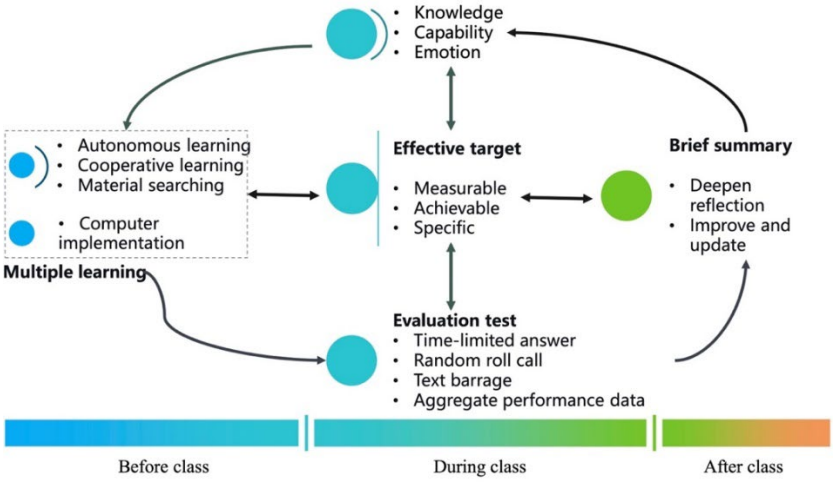

Figure 1: The framework of the blended course

The web development basis course has a strong practical, closely integrated with practical applications, and is an elective course in the software engineering major. If the teaching is based on the traditional approach, students only get the core knowledge. However, relevant coding skills cannot be internalized. And, students do not achieve coherence between content understanding and knowledge/skill acquisition. To process this problem, we built a blended class with the Rain classroom and Fanya online platform. Through blended teaching, we analyzed its role in improving student learning outcomes and explored the problems. The main framework of this blended teaching is shown in Fig. 1.

Based on the curriculum objectives, we identified three criteria that teaching and learning activities must meet: measurable, achievable, and specific. Thus, we constructed three phases in the whole teaching activity. The first is multiple learning which belongs to before-class learning. In this phase, a topic will be given to students and students will study this topic through independent or collaborative learning. Teachers also created an online course through the Fanya platform, which includes knowledge, explanatory videos, exercises, and support materials. Students can preview the knowledge before teaching or consolidate them afterward. It is found that Chinese university students spend more than 3 hours a day using WeChat[6], which can be considered an ideal tool to get closer to students. Thus, the slideshow is also sent to the WeChat APP on the phone of students. Meanwhile, we arranged bi-weekly hands-on lab sessions during the teaching semester. In the hands-on lab session, the students implemented a simple web layout effect based on their newly learned knowledge.

The second phase is the evaluation test, which belongs to the during-class learning. It is achieved through the Rain classroom software and traditional teaching. In traditional classroom teaching, we used this software in the following four scenarios: time-limited answer, random roll call, text barrage, and aggregate performance data. First of all, the concentration of students is low in the classroom and teachers' management tools for students' concentration are limited. Thus, fully mobilizing students' concentration is an important way to guarantee teaching quality. In our teaching, we used the rain classroom to allow students to answer questions within a limited time. The teacher will give a student a grade for this quiz based on his answers, which will be recorded in the software. This data becomes the score of the process of learning.

Besides, we also used random roll calls to select a student who answer the question given by teachers. With the help of these two methods, students will focus on listening to class lectures to earn more process learning scores. Students can also label the content that is temporarily difficult to understand through the "don't understand" button, and teachers will receive anonymous feedback that they don't understand. This allows the teacher to adjust the pace or focus of the lesson based on this information.

Furthermore, getting real-time feedback is also one of the most important tools to improve teaching quality. Before there was an information technology tool, real-time feedback could only be obtained through verbal communication. Now, with the Rain classroom software, the feedback can be sent to the class via cell phones in the form of pop-ups. When the teacher found it, they can quickly adjust their

ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

teaching according to the feedback.

The performance data also took a lot of work to quantify and summarize in the past. The Rain classroom provides all process scores of classroom teaching; the Fanya platform gives all independent study grades in a semester. With these data, the learning performance assessment is more justified.

Meanwhile, in each lesson, we added five to seven small quizzes to test the mastery of some details. We set a time limit for this answering task, and students must submit their results within this time. Otherwise, the answer task is seen as incomplete. After the student submits, the software immediately judges the answers to give feedback to students. In addition, the software also aggregates all records, such as the overall accuracy rate and other indicators. The teachers use this data to measure student mastery. We also randomly selected about ten students to answer the given questions on the spot to prevent the attention of students from drifting. This operation also tested the understanding and mastery of students.

The last part is a summary, which belongs to after class phase. With the software's feedback and the platform's aggregate date, any problems in teaching can be identified. For example, if students have difficulty grasping specific knowledge, the teacher can find it during pop-ups, random questions, etc. Then, the teacher can improve and update his teaching to get a better teaching effect.

2.2. Population and Sample

In the first semester of the academic year 2022 to 2023, we implemented the above-blended curriculum for all software engineering students in the class of 2020 and 2021. We have built an online course on the Fanya platform for students to study independently. The student age in the experimental group is 20.62, and the student age in the control group is 20.45. There are 103 males and 41 females in the experimental group; 109 males and 34 females in the control group. No significant difference is found between the two groups by t-test.

The teacher will teach the control group student with the traditional teaching approach. The differences between the two groups were in the use of integrated teaching methods and the details of the students' learning situations.

2.3. Data Collection Methods

The classroom test scores and the random question scores are saved in the database of the software. Teachers can export them from the system platform at the end of the semester. The text barrage information is converted into a quantitative term, namely the activity of students. The data of activity is also recorded in the system. The online course contains some online tests, the Fanya platform also gives a score to a student according to the answer to the online test.

With the value of these indices, the teacher can calculate the value of comprehensive ordinary grades. The formula for this calculation can be written as follows:

$$s_c = (s_r + s_o + s_w)/3 \tag{1}$$

where s_r denotes the Rain classroom score, it deflects the teaching-learning performance. s_o is the online test score, which means autonomous learning performance. s_w represents the homework score, it indicates the degree of mastery of students. s_c is a comprehensive score, which is used to calculate the overall score is this course.

Besides, the student is asked to form a small development team. This team will collaborate to develop a website. After development, the team needs to write a document to introduce the technical details of the project. Then, teachers evaluate the quality of the project and the document and give a comprehensive score to this collaborative task. This kind of score can be called as s_t.

Finally, a student will be given a final score, which is calculated as follows:

$$s_f = \omega_1 s_c + \omega_2 s_t, 0 < \omega_1 < 1, < \omega_2 < 1, \omega_1 + \omega_2 = 1 \tag{2}$$

where ω_1 and ω_2 are two weight parameters. In this semester, these two parameters are set as 0.3 and 0.7 correspondingly. After the above calculation, we get the final scores of all students in our course.

We also collected the satisfaction score of students for this course. The students are asked to rate their

ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

satisfaction with the course on a scale of 0 to 100. A score of 100 denotes completely satisfied, and a score of 0 is completely dissatisfied.

2.4. Data Analysis Procedures

We counted the scores of all students who participated in this blended teaching reform and also counted the scores of students who join in the traditional teaching type. These two kinds of data are compared to check whether the blended teaching reform has an improved effect on student learning. Also, we listed all the scores of s_r, s_o, s_w and s_t. By visual diagram, we want to find the relationship between the used blended method and the final learning performance of students.

2.5. Ethical Considerations

In this teaching reform, all the operations are designed to no harm or discomfort to the students. The reform obtained informed consent from students. Students are fully informed of the nature of the reform, including the purpose, potential risks, benefits, and any discomfort or inconvenience associated with participation. They are also made aware of their right to withdraw from blended teaching at any time.

Besides, the data in this reform have been kept confidential and only used for teaching research. Any other personal information, such as name and sex, will be kept secure and not disclosed to anyone without the consent of students.

We ensure the results are not misused and misrepresented. The data will be analyzed and interpreted responsibly and accurately, and any conclusion drawn will be processed based on sound scientific evidence.

3. Conclusions

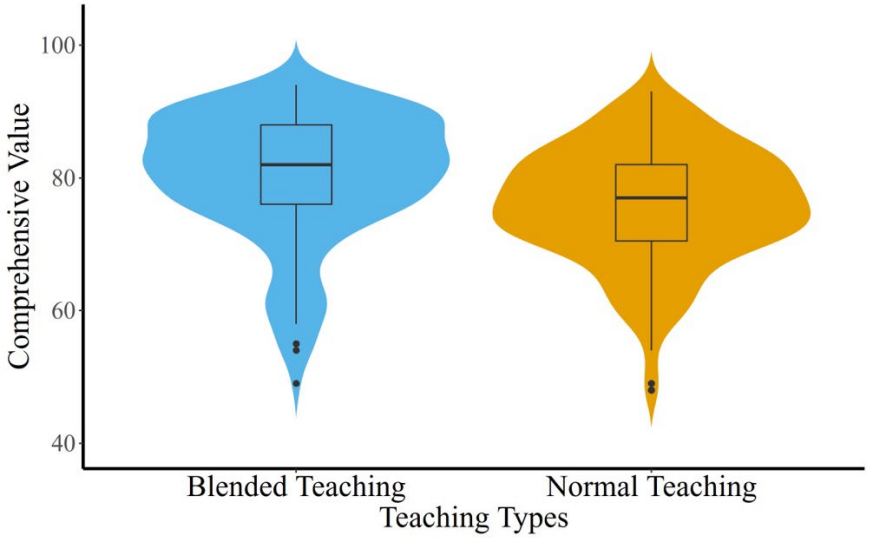

Figure 2: The comparison between blended teaching and normal teaching

From Fig. 2, it is seen that there is a gap of about 4 points between the mean value of blended teaching and normal teaching. The higher mean value of blended teaching proved the effect of this reform in improving the knowledge mastery of students. Besides, there are several abnormally low scores in normal teaching. After communicating with the students, it is known that the reason is the students are weak in learning motivation and do not spend time on this course without supervision. The students who participated in the blended teaching reflected the conclusion that blended teaching could effectively improve the learning initiative of students.

ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

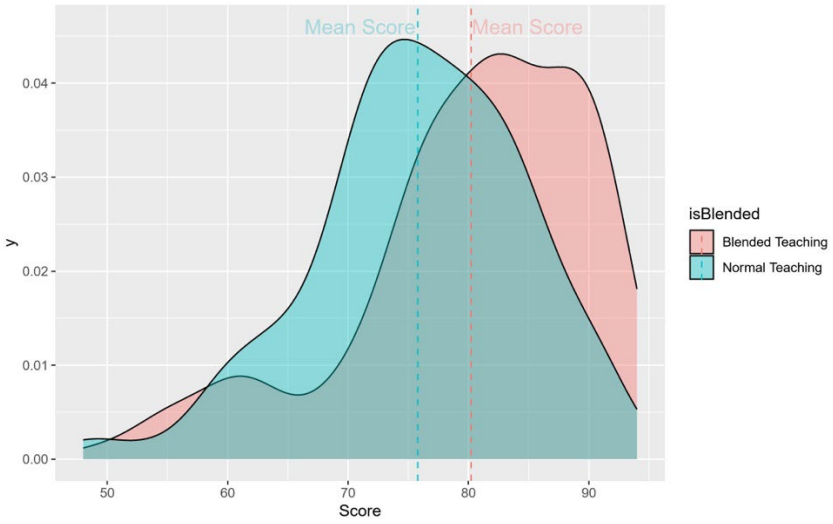

Figure 3: The probability density curve

In Fig. 3, the probability density is plotted. It is seen that the two types of data have different types of means, peaks, and shapes. In addition, we used the Kullback-Leibler dispersion measure[7] to calculate the likeness of these two types of data and found that the two data are less similar and have significant differences. Combined with the mean curve in the figure, we believe that blended teaching outperforms the traditional teaching approach.

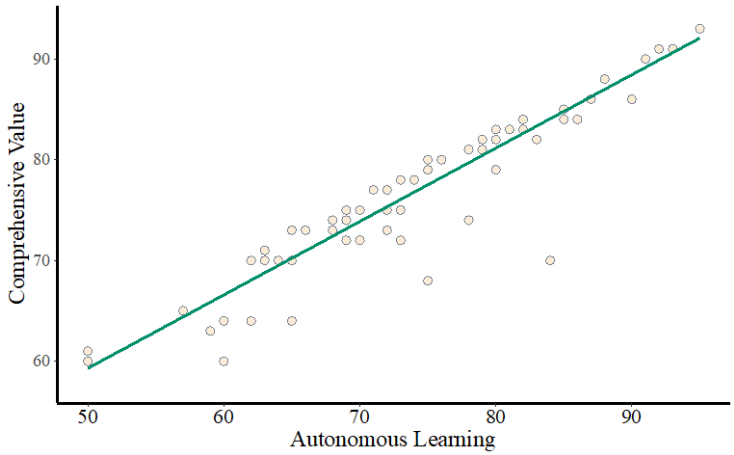

Figure 4: The scatter figure of Autonomous learning and Comprehensive score

From Fig. 4, it is found the relationship between autonomous learning and the final score is positively correlated. This phenomenon denotes that autonomous learning can make up for the lack of classroom education, and allow students to locate unfamiliar knowledge. Then, with the help of re-learning these unfamiliar points, students can achieve self-satisfaction at the end of the semester. Meanwhile, the fact also indicates regular or periodic self-assessment enables students to effectively evaluate their learning status. Thus, students correct their current situation according to this feedback information. As a result, they obtained a better learning score, which positively promotes the generation of self-satisfaction emotion.

4. Discussion

90% of students believe that teacher supervision and management are necessary to develop the independent learning skills of students[8]. Fig. 4 also demonstrates the method used in this study, such as time-limited answers and randomized questions, effectively served as supervision. These became an incentive mechanism to promote students' increased initiative and motivation in learning. This finding is generally consistent with the studies of other scholars[9,10]. It also provides some references for other teaching reform projects.

ISSN 2522-6398 Vol. 6, Issue 9: 13-18, DOI: 10.25236/FER.2023.060903

From the whole framework, it is known that the completion of a more comprehensive curriculum reform requires teachers to have a wide range of skills such as knowledge base, material collection, software use, information analysis, and statistics. In addition, the content before, during, and after the class should be coherent and unified, and the details of the integrated teaching process should be intertwined and progressive. All of this poses new challenges to the capacity building of teachers.

5. Conclusion

This paper builds blended teaching and learning for the introductory web development course based on traditional teaching methods, online learning, and interactive teaching software. Students are guided to learn independently in various ways before the class and internalize their knowledge during the class through time-limited questions, random questions, text pop-ups, etc. Data analysis, summary, and feedback are conducted after the class. After experimenting with software engineering students, we found that blended teaching can effectively mobilize learning conscientiousness and improve the teaching effect of students.

Acknowledgements

This research was funded by the University-Industry Collaborative Education Program (No. 220605862084753, No. 220601941012841, No. 220606434012620, No. 220606434023750, No. 220601941024150).

References

[1] Suwannaphisit S, Anusitviwat C, Tuntarattanapong P, et al. Comparing the effectiveness of blended learning and traditional learning in an orthopedics course[J]. Annals of Medicine and Surgery, 2021, 72: 103037.
[2] Dangwal K L. Blended learning: An innovative approach[J]. Universal Journal of Educational Research, 2017, 5(1): 129-136.
[3] Fathnejad F, Mokhtari A. Virtual education: the third generation. Monthly magazine Tadbir. 2007; 18:183. Persian.
[4] He Kerong, Shu Chunhua, LI Songsong, Wang Yuqing. Analysis on the Learning Effects of Contemporary College Students under the Rain Classroom Teaching Mode. Journal of Nanchang Normal University, 2022, 43(01):129-133
[5] Huang Chunmei. Design and Implementation of University Flipped Classroom Supported by "Rain Class- room + BYOD". 2021, 36(06): 156-160.
[6] Zhang Qiliang, Wang Aichun, Du Xiaoming. Application of Rain Classroom in experimental flipped classroom of software courses. 2021, 24(3): 105 - 108.
[7] Joyce J M. Kullback-leibler divergence. International encyclopedia of statistical science. Springer, Berlin, Heidelberg, 2011: 720-722.
[8] Lv Tingting. A Study on the Flipped Classroom Based College English Autonomous Learning Mode. Foreign languages in China. 2016, 13(01): 77-83.
[9] Liu Yan, Jiang Bing, Zhu Changping, Zhu Jinxiu. Design and Practice Research of Flipped Classroom in Bachelor Experimental Curriculum. Research and Exporation in Laboratory. 2016, 35(04): 201-204.
[10] Huang Shanshan, Zhang Jingwei, Lv Wenhui, Su Huashan, Zhou Haina, Liu Suhuai. Application of Virtual Interactive Experiment in the Experimental Flipped Classroom of Economical Courses. 2018, 37(07): 150-154.