Research on the Application of Blended Learning Model in Higher Vocational Teaching and Learning

Yaozhen Feng[1,a,*]

[1]Ningbo Open University, Ningbo, Zhejiang, China
[a]fengyz@nbou.cn
[*]Corresponding author

Abstract: On the basis of analyzing the application cases, teaching effects, and practice paths of blended teaching in higher education, combined with the Ningbo University Mucous Class Alliance and Super Star platform, as well as questionnaires and individual interviews with students, the authors of this paper designed a blended teaching model based on higher education teaching focusing on the diagnosis of learning conditions, learning supervision and intervention, as well as timely and correct evaluation and feedback. The effect of practical teaching shows that it is not only conducive to improving students' ability to analyze and solve problems, but also helps to improve the attitude of learning and stimulate the motivation of independent learning.

1. Introduction

With the rapid development of educational technology and information technology, traditional teaching will gradually be replaced by a blended teaching model, and blended teaching will certainly become a trend in the development of educational reform. The National Program for Medium- and Long-Term Educational Reform and Development (2010-2020) mentions: "Strengthen the application of information technology in national education and teaching. The level of application of information technology by teachers to update their teaching concepts, improve their teaching methods, and enhance the effectiveness of their teaching; At the same time, students are encouraged to use information technology to learn actively and independently, and to enhance their ability to use information technology to analyze and solve problems, promoting the spread and application of information technology."[1] In 2009, the United States emphasized that "blended learning is the most effective way of teaching", and Knewton indicated in The State of digital education that "by 2020, blended teaching will account for 98% of the total." [2], Clayton M. Christensen identifies blended learning as a disruptive innovation, and all future education and training will surely apply blended learning models [3]. Blended learning is now a common trend in application and development in basic and higher education [4].

Blended teaching needs to find a harmonious balance between traditional classroom and online learning and make a reasonable design and arrangement of teaching modes and teaching activities. Josh Bersin believes that blended learning is the optimal combination of various learning resources

[5]; Prof. Lai Jiahou believes that blended learning optimally selects and combines all elements of teaching and learning to achieve the teaching goals, to make teaching and learning reach a kind of artful realm. [6]Professor He Kexiang believes that blended learning combines the advantages of both traditional and digital learning, and that while teachers play a leading role in guiding, inspiring, and supervising the teaching process, they can more fully embody the students' subjective initiative, and play an active, proactive and creative role in the learning process. Professor Huang Ronghuai believes that how to use various teaching resources and give full play to the advantages of resources is an important issue to be considered in blended learning, depicting the design framework of blended course teaching and activities [8].

At the present stage, the design of blended learning mainly relies on teachers' experience accumulation and subjective judgement, which is divided into design planning before the implementation of the course, as well as the design summary at the end of the course, but lacks the dynamic design based on data analysis throughout the learning process [9]. In this paper, the dynamic design of blended learning is carried out according to the different characteristics of students' age, existing knowledge reserve, learning ability, learning style, etc. Taking the sophomore and junior students of a higher vocational college as the application and research object, based on the full study of the relevant literature, questionnaire survey, data analysis, etc., we design a blended teaching mode that is in line with the learning situation of higher vocational students.

2. Literature Review

In the early 1990s, along with the rise of e-learning, the international education field launched a heated debate on "whether universities with walls will be replaced by universities without walls (cyber colleges)", and in 2000, the U.S. Department of Education's "White Paper on Educational Technology" pointed out that e-learning will not replace school education, but it will greatly promote the purpose and function of classroom teaching and learning, which has gradually become the consensus of the international education community. The purpose and function of classroom teaching have gradually become the consensus of the international education community. After entering the 21st century, "Blended Learning" first appeared and was used in the field of corporate training, and then the international education technology community recognised the idea of blended learning, which was then introduced into school education, attracting many scholars to research on the theory of blended learning [10].

Different scholars in different fields have different views on the definition of blended learning. B-Learning White Paper of National Institute of Information Technology (NIIT), India, considers blended learning as a way of learning, 5Rs of Singh and Reed, scholars of American Developmental Training Association (ADTA) considers blended learning as a way of learning in which the learning environment is provided according to the learner's characteristics and needs, and the learning process is designed to be suitable, and the appropriate content is selected to achieve the best learning results,. Jennifer Hormann et al. believe that blended learning is an instructional design idea, and blended learning is an instructional design idea that uses the optimal media to present the best modules suitable for learners' learning, to achieve the best learning results, and Michael Orey believes that blended learning should be defined from the perspectives of the learner, the teacher or instructional designer, and the instructional administrator, and that each perspective has a different focus, while Margaret Driscoll provides a more comprehensive account of blended learning as a combination of many.

The earliest domestic blended learning is that Professor He Kexiang, on the basis of summarising the definition of blended learning abroad, thinks that blended learning is the complementary advantages of traditional learning styles and the advantages of online learning, Professor Lai Jiahou

thinks that the optimal combination of teaching elements of blended learning, Professor Li Kedong thinks that blended learning is a low-cost and high-efficiency teaching method, and Professor Huang Huairong proposes how to apply the blended Theory and Practice of Blended Learning, and Professor Huang Huairong proposed how to apply the theory of blended learning in teaching practice.

3. Blended Learning Design Based on Learning Situation Analysis

Based on three consecutive years of blended teaching courses for sophomores and juniors, this study designed and gradually improved a blended learning model for higher education based on data collected and analysed on the dynamics of the instructors and learners in several courses.

3.1. Research Target

There are 241 students in the 2014, 2015, and 2016 classes of Computer Application Technology in the School of Network Communication of a Ningbo higher vocational college. Some students took Image Processing in their freshman year from Ningbo University Mucous Class Alliance, and all students took Internet Application Development in the first semester of their junior year, using a blended teaching mode of online learning and classroom face-to-face teaching based on the Superstar platform. All students are more familiar with the online learning platform, so the blended teaching with online and offline integration can be used [11].

3.2. Research Process

Relying on the "Internet Application Development" course, the whole teaching week is 14 weeks (6 lessons per week), using project-based teaching, the teaching process around the design and implementation of an online bookstore, mainly including online bookstore function module design, interface design and programming implementation of three links. The students' task is to realize the project design according to the online bookstore function. Based on the comprehensive consideration of the characteristics of the learning situation of higher vocational students, this course is designed with three phases of tasks and a large homework. Phase I is in the first week of teaching, designing the functional structure and basic interactive interface of the online bookstore website; Phase II is 2-5 weeks of instructional week, using the webstorm tool to design bootstrap-based static web pages; Phase III is 6-10 weeks of instructional week to convert static web pages to dynamic web pages and program the internal logic. Comprehensive experiments on web implementation of online bookstore site functionality is carried out in teaching weeks 11-13.

The teacher explains the main content in the face-to-face classroom, focusing on the key points and difficulties, releases various learning tasks as the course progresses, and releases the task evaluation criteria in a timely manner; the main tasks of students in the face-to-face classroom are to organize the problems encountered in the online learning, to raise questions, discuss problems and solve problems. For each staged task, the minimum requirement is for students to complete the work in the online video (referred to as the classroom case); the higher requirement is for students to improve on the classroom case according to their own understanding and ideas; and the highest level is for students to be guided in designing personalized website work. After completing their work, students upload their work to the server, and the relevant lab teachers uniformly release their works on the platform and use self-assessment and mutual assessment among students for their work. In the 14th week, students demonstrate and explain their project work, students' mutual assessment, and teachers' final comments. The whole process is a blended learning process combining online learning and face-to-face classroom teaching. The main content is shown in table

1 below:

Table 1: Hybrid instructional design research process

Course content and tasks	Blended learning process	Data Analysis and Dynamic Design
Week 1: Introduction to the course (2 hours)	Online platform to publish questionnaires to assess students' knowledge and competence levels and self-efficacy scales	Collecting questionnaires, analyzing the data and interviewing individual students
Week 1: overall project introduction (4 hours), assignment 1: draw a functional structure diagram of the online bookstore website, design a simple interface	Online platform for submitting tasks 1 version 0 Self-assessment, student mutual assessment, student revision Face-to-face classroom presentations with on-the-spot teacher and student evaluations Online platform for submission of task 1 version 1	Analyzing data Task 1 results and online participation for the week Predictive modelling Predicted accomplishments for task 2
Weeks 2-5: Preparation of basic knowledge and fundamental skills for the realization of projects Assignment 2: Design a static web page based on bootstrap using webstorm tools	Online platform for submitting tasks version 2 0 Self-assessment, student mutual assessment, student revision Face-to-face classroom presentations with on-the-spot teacher and student evaluations Online platform for submission of task 2 version 1	Analyzing data Task 2 achievements and online participation in weeks 2-7 Validating prediction accuracy and modifying models Predicting Task 3 performance and making learning interventions
Weeks 6-10: Introduction to C# and Syntax Exercises Assignment 3: Convert a static web page into a dynamic web page and program internal logic	Online platform to submit tasks version 3 0 Self-assessment, student mutual assessment, student revision Face-to-face classroom presentations with on-the-spot teacher and student evaluations Online platform for submission of task 3 version 1	Analyzing data Task 3 achievements and online participation in weeks 6-10 Validating prediction accuracy and modifying models Predicting final big assignment completion and learning interventions
Weeks 11-14: Analysis and summary Assignment 4: Complete your own website modelled on an online bookstore	Online platform for submitting tasks 4 version 0 Self-assessment, student mutual assessment, student revision Face-to-face classroom presentations with on-the-spot student-teacher evaluations Online platform for submission of task 4 version 1	Analysing data Task 4 grades and online participation in weeks 11-14 Validating prediction accuracy and modifying models Predicting overall course grades and making learning interventions

4. Analysis of the Effects of Blended Learning

Based on three years of blended teaching, the teaching team analysed the students' online and offline learning data, and overall, compared with the control group, the overall learning effect of the class was better, and the learning style and completion rate of the works were improved.

4.1. Implications for Problem-solving Learning

Take the static page design part as an example, in order to investigate the completion of different levels of students, due to the characteristics of higher vocational students' learning, the judgement standard is set as "A, brand-new design, beautiful interface, reasonable layout; B, based on the classroom case design, with a beautiful interface and reasonable layout; C, which is basically the same as the classroom case; D, not completed". Two senior classes were selected for comparison, a class of 43 students implementing blended instruction (referred to as the implementation group) and another class of 45 students not implementing blended instruction (referred to as the non-implementation group), with 40 students in each of the two groups.
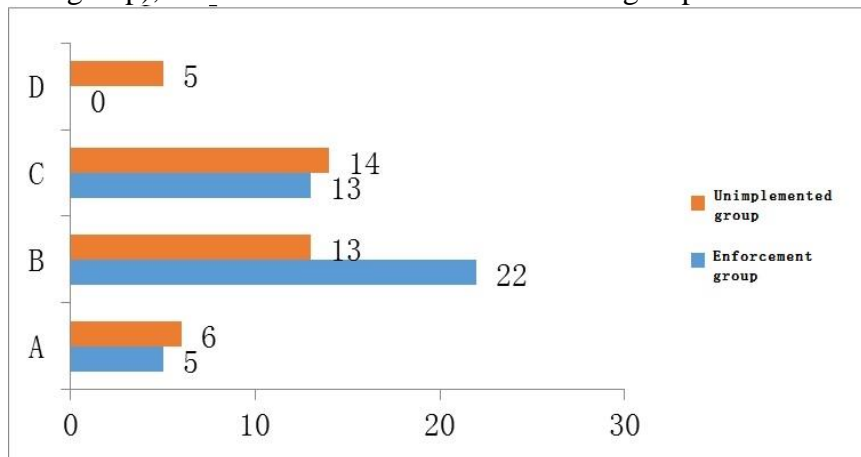

Figure 1: Comparison of the effect of blended instruction and regular instruction

From Figure 1, we know that the students with the grade of A, there is not much difference between the implementation group and the non-implementation group; there is a big difference between the students in group B. In blended teaching, more than half of the students, on the basis of completing the classroom case, can put forward new requirements for themselves, improve their assignments, stimulate learning motivation, and improve their problem-solving ability; the most noteworthy thing is that in the blended teaching, all students are able to complete the classroom case and complete the homework assigned by the teacher, which is the most affirmative aspect of blended teaching.

4.2. Impact of Blended Learning on Learning Attitudes

A Likert scale was used to measure the effect of blended learning on learning attitudes, with a maximum score of 5 and a minimum of 1, indicating from high to low: strongly agree, agree, unsure, disagree, and strongly disagree, respectively. A total of 43 questionnaires were distributed and 42 were returned, with 40 valid questionnaires and an overall Cronbach's alpha coefficient of 0.954. The questionnaires included (1) ability to complete simple tasks; (2) confidence in completing the task; (3) ability to complete complex projects; (4) personal interests; (5) connection to real life; (6) design task understanding and effort; (7) interface design concept or algorithm understanding; and (8) application of interface design concepts and algorithms. After adopting blended teaching, all dimensions of learning attitude slightly improved, confidence in completing the task, and understanding and application of interface design concepts or algorithms changed more, indicating that blended teaching has a significant effect on the enhancement of learning outcomes.
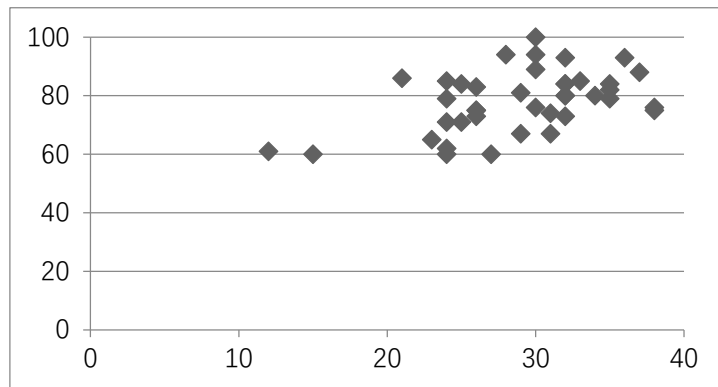
Figure 2: Relationship between learning attitude and performance

The horizontal coordinate in Figure 2 is the learning attitude and the vertical coordinate is achievement. The correlation coefficient between learning attitudes and grades is R=0.613, P<0.01, so blended teaching improves students' learning attitudes, especially confidence in learning, understanding and application of interface design concepts or algorithms, which leads to a greater improvement in the completion rate of the project, and the quality of completion.

5. Practical Paths of Blended Learning Based on Learning Situations

5.1. Focusing on the Diagnosis of the Learning Situation is a Prerequisite for Achieving Effective Mixed Teaching

Firstly, learning diagnosis helps teachers understand students' learning gaps. By analyzing students' learning history data, examination results, and classroom performance, teachers can gain an accurate understanding of students' knowledge, mastery, and learning difficulties, and identify effective measures to improve the learning gaps. This helps teachers formulate targeted teaching plans, provide specific and effective teaching guidance, and help students fully understand and master what they have learnt. Secondly, learning diagnosis promotes personalized blended instructional design. By understanding students' learning styles, learning preferences, and learning abilities, teachers can select suitable blended teaching resources and tools in a targeted manner. Personalized learning diagnosis and customized teaching can provide learning experiences that match students' individual needs, stimulate students' motivation and initiative, and improve learning outcomes.

In addition, the learning diagnosis can also effectively assess the effectiveness of blended learning. By monitoring students' learning performance and learning outcomes in a blended learning environment, teachers can assess the effectiveness of teaching and make timely adjustments to their teaching strategies. This helps optimize the design and implementation of blended learning and improve the quality and effectiveness of teaching. In this process, teachers need to design teaching content that is related to students' cognitive structure according to their existing knowledge level and ability composition, especially their learning in previous courses. Therefore, in the pedagogical design of blended learning, teachers must understand students' prior knowledge structure and ability level, and be good at guiding students to transition from existing knowledge to new knowledge; at the same time, they should pay attention to students' general deficiencies, care about students who encounter difficulties in learning, and give moderate attention to help promote them to complete the course learning. Understanding and analyzing students' learning situations is a prerequisite for achieving blended learning results.

In summary, focusing on learning diagnosis is a prerequisite for effective blended teaching.

Through the diagnosis of learning conditions, teachers are able to understand the learning gaps of students, implement a personalized teaching design, and make necessary adjustments by assessing the learning effects of students, thus improving the effectiveness and quality of blended teaching.

5.2. Focus on Learning Monitoring and Intervention as a Guarantee of Effective Blended Teaching and Learning

Firstly, studying monitoring helps teachers to identify in a timely manner the learning difficulties and confusions encountered by students in a blended learning environment and enable timely intervention. By regularly checking learning progress and assessing learning outcomes, teachers are able to identify students' learning needs, provide personalized guidance and support, and ensure that students fully understand and master what they have learned. Second, learning interventions are an important means of guiding students toward active learning and problem solving in blended learning. Teachers can stimulate students' interest and motivation through regular interactions and feedback, and help them establish good study habits and independent learning skills. By providing real-time guidance and advice, teachers can help students overcome learning difficulties, develop critical thinking and problem-solving skills, and improve learning outcomes.

In addition, learning monitoring and intervention help monitor the learning process and assess the effectiveness of teaching and learning. By collecting and analyzing learning data, teachers are able to understand students' learning behaviors and strategies in a blended learning environment, as well as the actual effects of learning outcomes. This will help teachers make timely adjustments to teaching methods and resource allocation, optimize the design and implementation of blended learning, and enhance the overall teaching quality and students' learning experience.

Learning, monitoring and intervention is essential, especially for less autonomous groups such as higher education students. Struggling and top students are the ones who need special attention. Teachers can use the online platform's learning data analysis tool and learning activity prediction tools, and combine them with their own experience and judgement to monitor and analyze the causes of students who have developed or may develop learning difficulties, supervise their learning progress and provide them with personalized teaching in order to help them successfully complete their learning tasks. Meanwhile, for students with excellent performance, teachers can enhance extracurricular outreach, promote their learning through competitions and projects, and keep them in close contact with society and enterprises. For average students, big data analysis can be used to explore their potential, improve their self-identity, and motivate them to learn, to achieve truly effective teaching.

In summary, a focus on learning, supervision and intervention is a key element in ensuring the effective implementation of blended learning. Teacher monitoring and intervention can provide targeted support and guidance to help students overcome difficulties and achieve their learning goals, ultimately leading to successful blended learning.

5.3. Timely and Correct Evaluation and Feedback Contributes to an Effective Mix of Teaching and Learning Activities

Firstly, evaluation and feedback help teachers to understand students' learning status and progress in the blended learning process, so that they can adjust and optimize their teaching strategies in a timely manner. Secondly, evaluation and feedback stimulate students' independent learning and self-reflection, and enhance their motivation and active participation. In addition, evaluation and feedback can accurately assess the learning outcomes and effects, and provide teachers and students with effective reference and guidance to further improve the quality of teaching and learning outcomes. Therefore, teachers and scholars should attach great importance to

the importance of evaluation and feedback and continue to explore evaluation and feedback strategies suitable for blended learning environments in order to promote effective teaching and learning activities.

6. Conclusions

In addition, through interviews with students, it was found that individual students who had not received timely and correct feedback for a long period of time would become slack and not actively participate in learning activities such as exchanges and discussions, resulting in blended teaching not being able to proceed smoothly. Therefore, timely evaluation and feedback not only make students feel that the technology is convenient and easy to use and reduce the sense of rejection of the technology, but also motivate students to continue learning and make up for the lack of group and sense of belonging in the virtual learning environment. In addition, appropriate rewards and punishments not only stimulate students' motivation to learn, but also help to cultivate their sense of self-efficacy. In summary, evaluation and feedback play a crucial role in blended learning.

References

[1] Outline of the National Medium- and Long-Term Education Reform and Development Plan (2010-2020).

[2] The State of Digital Education. http://www.knewton.com/digital-education/

[3] Christensen C M, Horn M B, Staker H. Is K-12 Blended Learning Disruptive? An Introduction to the Theory of Hybrids. Clayton Christensen Institute for Disruptive Innovation, 2013.

[4] Johnson M C, Graham C R. Current Status and Future Directions of Blended Learning Models. Encyclopedia of Information Science & Technology Third Edition, 2015.

[5] Bersin J. The Blended Learning Book: Best Practices, Proven Methodologies, and Lessons Learned. 2004.

[6] Lai Jiahou. Reconstruction of teaching methods in the sense of teaching and learning - from microcourse pedagogy. Information Technology Education for Primary and Secondary Schools, 2014(9):12-14.

[7] He Kexiang. On the integration of information technology and curriculum. Shanghai e-learning, 2003, 26(2):2-7.

[8] Huang Ronghuai, Martin, Zheng Lanqin et al. A course design theory based on blended learning. Research on Electrochemical Education, 2009(1):9-14.

[9] Li Shengbo, Chen Li, Zheng Qinhua. A survey study on course design of MOOCs in China. Open Education Research, 2016, 22(2):46-52.

[10] Sujanta Kazemanzadeh. Distributed System Integrating Virtual Reality Technology in English Teaching. Distributed Processing System (2022), Vol. 3, Issue 1: 62-70.

[11] Pecka Katrin. Network Teaching System of Power Machinery Based on Computer Science. Kinetic Mechanical Engineering (2021), Vol. 2, Issue 4: 21-30.