# Research on Blended Teaching Evaluation based on Data Analysis

Shen Ning [1,*] Hua Xiang [2] Zhi-cheng Li [3]

[1] *School of Artificial Intelligence Jianghan University*
[2] *School of Artificial Intelligence Jianghan University*
[3] *School of Artificial Intelligence Jianghan University*
[*] *274912440@qq.com*

**ABSTRACT**
Blended teaching combines the advantages of online learning and classroom teaching, pays more attention to students' learning process and ability cultivation, and diversified teaching means and methods are more conducive to high-order learning for students. Based on the learning data of students in the blended teaching process of the course "fundamentals of computer", this paper uses data mining and machine learning algorithm to mine the historical learning data, find meaningful patterns and rules, and carry out evaluation research under the blended teaching model. This paper also analyzes the evaluation indicators of students' learning status, establishes the supervision model and assessment model, and constructs the hypothesis of the relationship between online learning behaviour and blended learning performance, providing guidance for teachers to carry out blended teaching.

***Keywords:*** *blended teaching, data mining, evaluation model, higher-order learning.*

## 1. INTRODUCTION

With the advent of the "Internet +" era, the rapid development of the new generation of information technology has led to significant changes in the teaching model. The teaching environment of traditional classroom is developing towards intelligentization and informationization. With the rise of various online teaching platforms, the blended teaching model based on online teaching platform is more and more used. Blended teaching is a combination of online learning and offline classroom learning. In the process of blended teaching, teachers build a variety of learning resources on the online teaching platform, students use online learning resources to study independently, and teachers also arrange offline classroom teaching synchronously. Offline classroom teaching in blended teaching is fundamentally different from traditional classroom teaching. In online class, the teaching task of teachers is no longer to teach knowledge, but to use discussion, group project collaboration, tests and other ways to understand the actual learning of students, and then targeted to guide students personalized learning.

## 2. HIGH-ORDER LEARNING TEACHING MODEL IN BLENDED TEACHING

Higher-order thinking is also translated as advanced thinking or higher-level thinking, which is the mental activity or cognitive ability at a higher cognitive level [1]. The idea of higher-order thinking originated from the taxonomy of educational objectives (1956) of Bloom, a famous American psychologist and educator, which divides learning objectives from low to high into six categories: knowledge, understanding, application, analysis, synthesis and evaluation. In 2001, Anderson et al. revised Bloom's taxonomy of educational objectives, dividing the cognitive process into six levels: memory, understanding, application, analysis, evaluation and creation. The first three levels belong to the lower level, and the cognitive activities at this level develop the lower order thinking. The last three levels belong to the higher level, and the cognitive activities at this level develop higher-order thinking. Higher-order thinking ability is reflected in learners' problem solving ability, decision-making ability, critical thinking and creative thinking ability [2].

The learning activities that allow students to use higher-order thinking are called higher-order learning,

and the corresponding teaching mode is higher-order learning teaching mode. Higher-order learning is completed by learners in the process of completing new tasks and solving new problems. Therefore, the logic of advanced learning must have the characteristics of discovery, that is, it has the function of question logic and innovation: by guiding students to learn, understand and comprehend, then learn and master a scientific research method; and give students insight into the frontiers of the subject, as well as into all kinds of unknown areas [3]. Classroom is the main form of teaching implementation, but the traditional classroom is "cramming" indoctrination classroom, knowledge indoctrination is the main body of the classroom, the teacher becomes the authority of knowledge, students passively accept knowledge, the teaching process has become the "copy" process of knowledge. Contemporary college students lack advanced thinking ability, serious thinking mode and poor thinking conversion ability, which leads to students cannot master knowledge well, and then affect students' application and practice of knowledge [4]. High-order learning teaching mode takes students as the main body, "learning" as the center, and teaching activities as the carrier. As the guide and helper of students' learning, teachers no longer occupy the dominant position in class [5]. In mixed teaching, diversified teaching methods and means help teachers shift the focus of teaching from explaining traditional knowledge points to focusing on students' mastery of skills, expansion of knowledge depth and breadth, and improvement of ability.

## 3. DATA ANALYSIS MODEL

### *3.1 Blended Teaching Data Platform*

Data platform is the core of blended teaching, which can integrate and collect all kinds of learning data, including offline and online classroom learning. In blended teaching, students' learning process is divided into several stages according to the teaching content. Teachers divide the whole teaching process into several teaching units according to the teaching progress. Each teaching unit includes two stages: online classroom and offline flipped classroom. At the end of each stage, students are evaluated. The comprehensive evaluation of each student consists of the final assessment and the evaluation of the whole learning process. Learning process evaluation includes online teaching platform evaluation, stage evaluation, offline homework and experiment. This multi-stage comprehensive evaluation method is more reasonable and effective for the evaluation of students' daily scores. At the end of each stage, students know their own evaluation grade. The new teaching evaluation system can not only improve students' learning enthusiasm, but also achieve a fair and comprehensive evaluation of the whole learning process[6] [7].

### *3.2 Data Analysis*

The learning data recorded by students on the learning platform can be divided into explicit learning records and implicit learning records.

Explicit learning is a learning behavior that can be measured and observed directly. Explicit learning is related to knowledge and skills. Explicit learning evaluation includes data such as attendance, homework, experiments and periodic assessments on classroom learning platforms and data provided on online platforms. These learning tasks are the basic tasks that students must complete in the learning process, so the evaluation of these explicit learning behaviors is the basic evaluation of students. Including the following aspects:

Online learning: it includes important online learning records such as watching learning videos, answering test questions, homework assigned by teachers and scores of quizzes. The online teaching platform will give a comprehensive evaluation of students' online learning.

Stage evaluation: At the end of each stage, students will be tested in real time in offline classes, and test papers will be formed independently by question banks and automatically marked by the system. Real-time in-class tests ensure that the exam is objective and fair, and the assessment requirements will be slightly higher than the final exam.

Experiments and exercises assigned in offline classrooms: In online classes, students are required to complete experiments and exercises previously assigned in traditional classrooms. Experiments and exercise data are recorded from the classroom learning platform, and these tasks complement the online learning tasks.

Final assessment results: The final exam, like the stage test, will be conducted by the question bank and automatic marking by the system. The final exam evaluates students in terms of achievement of teaching objectives.

Implicit learning is a learning activity conducted by learners according to their own inner feelings, which is linked to implicit abilities such as learning ability, learning attitude, cooperation and communication ability. In the learning process, some characteristics can be quantified, such as the number of topics discussed in class activities, students' score for answering questions, etc., but there are also non-quantifiable characteristics, such as learning ability, analytical ability, etc. In view of the unquantifiable characteristics, it is necessary to design research learning activities to investigate students' invisible ability.

At each learning stage, students have basically mastered the teaching content after completing the learning tasks in the online classroom and enter the offline flipped classroom. In offline flipped classroom,

teachers analyze, and summarize online learning, explain the key and difficult points of knowledge, and guide students to flexibly use knowledge to solve problems through various classroom activities and group activities.

Offline classroom teaching activities mainly include students' questions to teachers, teachers' explanation of key and difficult points in knowledge points, arrangement and explanation of experiments and exercises, interactive discussions between students and teachers, and other classroom activities. Real-time interactive tools provided by online teaching platforms (such as class selection, real-time discussion, pre-answering, voting, etc.) can not only facilitate teachers to use mobile phones to carry out various activities with students in class, but also effectively record classroom activities, and quantify the performance of classroom activities with points. For the unquantifiable characteristics, group project teaching is adopted by using the group cooperation module of online teaching platform. Students work in groups to complete the work and present it to the class. Students and teachers grade the work together. The group cooperation project focuses on students' independent learning ability and comprehensive application of knowledge. In the process of project completion, students learn related knowledge points and complete the works independently, and teachers help students solve the problems in the process of design and production of the works. After the completion of the works, teachers analyze and comment on each group of works in class, and students evaluate each other among groups. The evaluation of students' learning ability is quantified into teacher's score and student's score of group work.

Before class, students use online learning resources to study independently, which requires self-study and communication skills. In class, students participate in various teaching activities, need dialectical criticism, differentiation, application and other abilities. After class, students need to carry out homework evaluation, project design, work display, analysis, synthesis, innovation and other skills. These behaviors together constitute the elements of the evaluation of students' higher-order abilities.

After accumulating data, blended teaching data center can be used to analyze students' learning status in two ways. The simple mode uses data filtering mode to stratify students. Through big data analysis, an analysis model of students' learning behavior is constructed to provide a basis for intelligent recommendation. Since a large amount of data needs to be accumulated, research has been started at present.

## 4. TEACHING PRACTICE

### *4.1 Teaching Process*

Since 2018, the blended teaching model of course “College Computer Foundation” has been adopted, and this course was approved as the first batch of national blended Teaching Gold course in 2020. In 2021, on the basis of the previous teaching, it continued to strengthen the integration of information technology, developed and put into use new learning platforms -- Computer Integrated Platform and Computer Virtual Simulation Experiment Platform, and improved multi-platform teaching resources. Multi-platform collaborative work, students can get personalized portrait, supervision, guidance and comprehensive evaluation. There are clear learning tasks arranged before class to guide students to study independently. In class, students' weak links and difficult knowledge points were identified based on the results of pre-class tests, and various classroom teaching activities were organized, such as group cooperative learning and in-group discussion, to complete advanced tasks. After class, students are provided with additional resources based on their learning process in class. Students complete assignments, group projects, and evaluate other students' works.

The course "College Computer Foundation" divides the whole course into 8 stages according to the knowledge system, and stage tests are conducted at the end of each stage. Use "Computer Integrated Platform" to record and integrate students' learning process data. The recorded teaching data comes from” Super Star” online platform learning data and experiments, exercises, tests and other self-data. Advanced homework, classroom activities and group cooperation projects completed by students are included in the usual scores. These projects are the evaluation of students' high-order abilities and can better reflect students' enthusiasm and learning effect.

Group cooperation teaching is adopted in some chapters. Students will design the works in groups and demonstrate them in class. The works will be evaluated by groups and teachers. Excellent works will be rewarded with bonus points. In the process of project completion, students learn related knowledge points independently and complete the work through group division and cooperation. Teachers help students solve problems in the process of design and production of the work, analyze and comment on the work. Group activities enhance students' participation and learning interest.

### *4.2 Supervision Model*

At each end of the learning phase, each student's learning process detailed records from the teaching platform can more comprehensively and objectively evaluate the stages of the learning situation than the

traditional way of examination. By the platform rule set, evaluation of the students in different stages of the evaluation level is divided into five levels- ABCDE. Teachers supervise students according to their evaluation grades, and students at different learning levels will be notified of the supervision. Online class carries out stratified teaching for students, requiring unqualified students to attend offline classes and study under the supervision of teachers. For qualified and outstanding students, they can study independently and be guided to learn high-order content.

### *4.3 Evaluation Model*

At the end of the whole course, the teacher gives a comprehensive evaluation according to the learning situation of the whole semester. The traditional teaching assessment method generally takes 30% of the usual score, and 70% of the final exam. The usual score is generally evaluated by the students' attendance and homework scores, which is mainly based on summative evaluation and cannot achieve the evaluation of students' high-order learning. After adopting blended teaching, the new evaluation rules are 50% of the usual score and 50% of the final exam, which weakens the final exam, increases the proportion of the usual score and introduces formative evaluation. The daily scores of the mixed class are mainly composed of online learning, offline classroom, stage test and high-order tasks, as shown in Table 1. The higher-order task data are selectively provided by the teacher according to the actual situation of the class in the blended teaching process of this semester.

**Table 1**. Table of Evaluation of high-order learning teaching model

| Evaluation dimension | Evaluation phase | Evaluation index |
|---|---|---|
| Formative evaluation | Stage before class | Online learning task completion |
| | | Test before class |
| | Stage during class | Participation in class discussion |
| | | Class activity points |
| | | Team work points |
| | | Experiment in class |
| | | Higher-order task |
| | Stage after class | Group work (teacher evaluation, inter-group evaluation, intra-group evaluation) |

### *4.4 Effect*

According to the final examination results of the classes with blended teaching for several consecutive years, the final examination results of the blended teaching classes are better than those of the traditional teaching classes. With the support of the new blended data platform, the evaluation system of blended teaching in 2021 is more perfect than previous years, with more detailed stage evaluation, more standardized supervision of teaching process and more advanced teaching content.

Figure 1 shows the proportion of the number of students in each score section of classes in different years with different teaching methods.

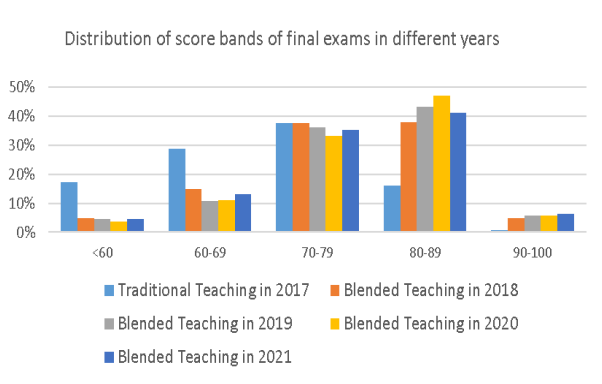


**Figure 1** Population distribution proportion of each score segment in different years

## 5. CONCLUSION

Blended teaching, which combines Internet technology with traditional teaching, has become an inevitable trend of online learning. In the assessment and evaluation of students' learning, not only the summative assessment of the final exam is used, but also the formative assessment is introduced [8]. The stage process assessment changes the bad habit of students' last-minute cramming at the end of the semester, promotes the formation of good learning habits of students and achieves better teaching effects. The online and offline blended teaching mode has also been promoted to other courses such as "C language programming" teaching.

## ACKNOWLEDGMENTS

This paper is one of the stage results of the key project of the special teaching and research for young teachers in 2020 of Jianghan University, “Research on SPOC Based Hybrid Teaching Multiple Evaluation System" (JyQ2020003).

## REFERENCES

[1] Zhong Zhixian,The Framework of Teaching Design for knowledge Era -Promoting learners'

development[D], East China Normal University.2004

[2] Zhao Yongsheng, Liu Cui, Zhao Chunmei,Higher Order Thinking ability and project Teaching [J], Higher Engineering Education Research, 2019(6),145-148,179

[3] Xie weihe, on the scientific nature of college courses [J], China university teaching,2018,(2)46,13

[4] Fu haidong, du wei, research on cultivation strategy of higher order thinking ability in universities [J], journal of changchun university,2015(10),110-112

[5] Liu Wei, Xiong Yonghua, Wang Guangjun. Discussion and Practice on the teaching mode of advanced learning in engineering courses under the new engineering background [J],Higher Engineering Education Research, 2021(3),163-168

[6] Ning Shen, Hua Xiang, Zhi-cheng Li, Research on Real-time Evaluation Strategy in Blended teaching of Online Courses. 2020 International Conference on Education, E-learning and Social Science (EELSS2020),2020.6,280-285

[7] Ning Shen, Bin Yan,the Research on Teaching Practice of SPOC for Blended Learning, 2019 International Conference on Management Innovation, Education Reform and Applied Social Science (MIERASS2019) ,2019.4,171-175

[8] Feng Chan, Research on the construction and application of hybrid teaching mode promoting deep learning [D],Master, Hebei Normal University,2019