Course Assessment System Construction of '*Big Data System and Technology*' in Blended Teaching Mode

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Abstract. Focusing on the problem of evaluation of blended teaching effectiveness for courses in the context of engineering certification, following the OBE concept, adopting both process and outcome assessment, and taking teachers and students as the main subjects of assessment, the principles that should be followed in blended teaching assessment are proposed; And a result-oriented course assessment index system have been constructed from three dimensions of learning initiative, learning process and learning effect under the blended teaching mode. Taking the course '*Big Data System and Technology*' in the School of Software Engineering, Chengdu University of Information Technology as an example, how assessment indicators can effectively supporting graduation requirement are explained from three aspects: course objectives, course assessment system practice, and calculation of course objective achievement. Practice shows that the result-oriented course assessment system under the blended teaching mode can objectively evaluate the learning effect of students, improve their interest and ability of independent learning, and achieve the intended knowledge, ability and value objectives of the course.

Keywords: Blended Teaching · Result-oriented · Course Assessment System · Process Assessment · Outcome Assessment

1 Introduction

Blended Teaching is a new teaching model that intersperses online and offline teaching methods and combines them in the teaching process [1]. The model is based on student-centered and teacher-led, and emphasizes the development of students' independent thinking and independent learning skills, Blended teaching divides the whole teaching process into three stages: before, during and after class, and realizes the effective integration of offline and online teaching from several aspects: teaching theory, teaching environment, teaching resources and teaching methods [2]. The course assessment is an important way to test the understanding and application ability of students and the teaching effectiveness of teachers, and it is an indispensable part of teaching activities. Under the blended teaching mode, the traditional course assessment method needs to

be abandoned, and the level and ability of students should be assessed scientifically, objectively and fairly.

In recent years, a series of researches and practices had been conducted on the issue of course assessment and evaluation under the blended teaching model. P. Lu [3] constructed an online learning effectiveness evaluation index system for higher education students, guided by formative evaluation theory and combined with the online teaching implementation process of the blended teaching model. Q. Gao [4] researched the evaluation subject and evaluation index of comprehensive evaluation of teaching quality under the blended teaching mode, and constructed a blended teaching quality evaluation system based on big data information technology. H. J. Cao [5] proposed the idea of building a course quality evaluation mechanism that takes into account teaching management and teaching support. Y. Cao [6] designed a blended teaching evaluation model, evaluation indexes and index weights based on CIPP, and constructed a blended teaching evaluation system. J. L. Wang [7] proposed a blended teaching approach based on the knowledge capsule model and constructed a learning outcome evaluation system including five dimensions of learning objectives, learning attitudes, learning abilities, learning processes, and learning content. X. F. Lei [8] carried out a blended teaching of physical chemistry with organic integration of independent learning and informational classroom teaching, and constructed a process assessment and evaluation system to accompany the teaching with a competence-oriented approach. Y. Wang [9] et al. practiced the capability-oriented blended teaching method of 'five-link' in Data Structure, and established a multi-dimensional evaluation system to comprehensively evaluate the five aspects of the course, so as to cultivate students' ability to solve complex engineering problems. Q. J. Lu [10] et al. deconstructed, analyzed, reorganized and designed Discrete Mathematics with the guidance of ability cultivation. And with the help of intelligent teaching platform and tools, they explored and practiced multiple blended teaching mode, enabling students to have the application ability of mathematical theories, models and methods. D. M. Ren [11] proposed an online and offline blended teaching scheme for Operating System oriented by cultivating students' ability, and gave detailed construction, implementation steps and methods of blended teaching methods, so as to give full play to students' learning initiative and improve their comprehensive ability.

Accreditation of engineering education aims at the future development of students as an educational goal and aims to improve their general ability and capability [12], and it is generally recognized in the field of higher education. At the curriculum level, it is manifested in the full implementation of outcome-based education (OBE) teaching concept. This requires that curriculum setting, teaching, assessment and evaluation should be based on the training objectives [13], and fully reflects student-centeredness and takes student learning results as the only criterion for teaching quality monitoring and evaluation. Therefore, on the basis of constructing a result-oriented course assessment index system under the blended teaching mode, this paper takes '*Big Data System and Technology*' as an example, and illustrates the specific practice of the assessment index, so that the assessment results can fully and objectively reflect the actual situation of students.

2 The Principles of Constructing Result-Oriented Course Assessment Indexes Under the Blended Teaching Model

Under the OBE concept, the teaching methods, teaching tools and teaching evaluation of the course should be aimed at the cultivation and enhancement of students' abilities. Thus, the assessment of courses under the blended teaching model must reflect the achievement of competency goals. At the same time, taking into account that the purpose of course assessment is to improve teachers' teaching quality, stimulate students' enthusiasm for learning and promote continuous improvement of the course, the result-oriented course assessment under the blended teaching model should be based on the following principles:

1. Assessment should be the central element to achieve the goal

OBE is focused on five questions: What learning outcomes are students expected to achieve? Why is it important for students to achieve such learning outcomes? How to effectively help students achieve these learning outcomes? How to know that students have achieved these learning outcomes? How can student achievement of these learning outcomes be ensured? Course objectives answer the question 'what learning outcomes are students expected to achieve ', blended learning answers the question 'how to effectively help students achieve these learning outcomes', and course assessment answers the question 'how to know that students have achieved these learning outcomes '. It can be concluded that the blended learning model is a means to guarantee the achievement of course objectives, while course assessment is used to measure the effectiveness of blended learning. Therefore, the course should focus on the achievement of the three levels of knowledge, ability and value as the focus of assessment, following the principle that the achievement of goals is the core element.

2. The assessment body should be diversified

The 'student-centeredness' is emphasized by both the blended teaching model and the OBE concept. Therefore, student participation should also be emphasized in the assessment. On the one hand, the objectivity of the assessment can be reflected, and on the other hand, it also contributes to the achievement of the course competence objectives. Specifically, it is based on teacher evaluation, with student self-assessment and mutual assessment included in the assessment system in the necessary links. The diversity of assessment bodies helps to avoid partial and biased of the assessment, and improves the authenticity and validity of assessment conclusions.

3. Combination of process assessment and result assessment

Blended teaching divides the teaching process into three stages: before, during and after class, emphasizing active learning by students, teacher-student interaction and cooperative learning among learners. The traditional assessment method, which takes the final exam as the only criterion, focuses attention on knowledge objectives, ignoring the realization of competence and value objectives, and cannot cover the whole process of blended teaching, which is partial. Therefore, it is necessary to combine process assessment with result assessment, process assessment used to reflect the effect of students' independent learning and course participation in the three learning processes

before, during and after class, and to measure the achievement of competency and value goals. And the outcome assessment is used to reflect the final effect of blended teaching and to measure the achievement of knowledge objectives.

3 Result-Oriented Course Assessment Index System Under Blended Teaching Mode

Following the OBE concept, adopting process assessment and result assessment, taking teachers and students as the assessment bodies, the courses under the blended teaching mode is assessed in three dimensions: learning initiative, learning process and learning effectiveness. On the dimension of learning initiative, the indicators are mainly considered the number of times of platform login, platform login time, number of video views, questioning and posting communication, group activity participation and attendance, etc. In the learning process dimension, indicators such as exercise completion, homework completion, lab completion and flipped classroom are mainly considered. On the learning effectiveness dimension, two main indicators are considered: stage test scores and final exam scores. It can be concluded that the three primary indicators and 12 secondary indicators constructed cover the three stages of blended teaching: before, during and after class, which are more comprehensive and objective in evaluating students' learning and have better operability. It should be noted that some of the assessment indicators require the support of the teaching platform. The assessment methods, assessment bodies and competence objectives of each assessment index are shown in Table 1.

4 Practice of Result-Oriented Course Assessment System Under Blended Teaching Mode

'*Big Data System and Technology*' is a foundation course in the Big Data series, which Hadoop is used as a carrier to explain the basic concepts of big data and basic knowledge of distributed storage, distributed processing and big data analysis, so as to lay a foundation for students to engage in professional engineering work. Since the opening of '*Big Data System and Technology*' in the School of Software Engineering of Chengdu University of Information Technology, software engineering professional engineering certification is made as an opportunity to explore and practice the result-oriented course assessment system under the blended teaching mode based on the OBE concept, and achieved good results.

4.1 Course Objectives

The course '*Big Data System and Technology*' of Chengdu University of Information Technology mainly contains an overview of big data technology, Hadoop basic environment configuration, Hadoop design ideas and basic architecture, distributed storage HDFS, computing framework MapReduce, YARN framework and big data practice. The course objectives and the corresponding graduation requirements are as follows:

Table 1. Result-oriented course assessment index system under the blended teaching model [Self-drawn]

Primary assessment indicators	Secondary assessment indicators	Assessment method	Assessment body	Competence objectives
Learning initiative	The number of times of platform login	Process assessment	Teacher	Value objectives: Learning attitudes and habits
	Platform login time		Teacher	Value objectives: Learning attitudes and habits
	Number of video views		Teacher	Learning objectives: Memorization and comprehension Competence objectives: Learning and learning methods Value objectives: Learning attitudes and habits
	Questioning and posting communication		Teacher	Competence objectives: Problem identification and problem solving Value objectives: Learning attitudes and habits
	Group activity participation and attendance		Student self-assessment and mutual assessment	Competence objectives: Teamwork, communication and expression Value objective: Collaboration and participation
	Attendance		Teacher	Value objectives: Learning attitudes and habits

Table 1. (*continued*)

Primary assessment indicators	Secondary assessment indicators	Assessment method	Assessment body	Competence objectives
Learning Process	Practice completion		Teacher	Learning objectives: Knowledge understanding Competence objectives: Critical analysis Value objectives: Problem solving
	Homework completion		Teacher	Learning objectives: Internalization of knowledge Competence objectives: Critical analysis Value objectives: Problem solving
	Experiment completion		Teacher and student mutual assessment	Learning objectives: Application of knowledge Competence objectives: Practical hands-on skills Value objectives: Theory and practice

(*continued*)

Table 1. (*continued*)

Primary assessment indicators	Secondary assessment indicators	Assessment method	Assessment body	Competence objectives
	Flipped classroom performance		Teacher, student self-assessment and mutual assessment	Learning objectives: Understanding and application Competence objectives: Logical thinking, unity and collaboration, communication and expression Value objectives: Cooperation and competition
Learning effectiveness	Stage test results		Teacher	Learning objectives: knowledge deepening Competence objectives: Knowledge application Value objectives: Problem solving
	Final exam results	Outcome assessment	Teacher	Learning Objectives: Knowledge application analysis Competence objectives: Knowledge application Value objectives: Problem solving

Course objective 1 is to master the construction and configuration of a Hadoop cluster. The objective supports the graduation requirement '5.1 Understand the principles and use of specialized modern instruments, information technology tools, engineering tools and simulation software, and understand their limitations'.

Course objective 2 is to master the HDFS file storage mechanism and to master the HDFS shell and API to implement file storage. The objective supports the graduation

requirement '3.3 Be able to design industry application software and demonstrate a sense of innovation in the design and development process'.

Course objective 3 is to master the MapReduce principles and execution process, the YARN computational model, and the programmatic implementation of the MapReduce process. The objective supports the graduation requirement '2.2 Be able to correctly represent complex engineering problems in software based on relevant scientific principles and mathematical modeling methods such as behavior and structure of a unified modeling language'.

Course objective 4 is to implement Hadoop for data analysis and data mining. The objective supports the graduation requirement '4.3 Be able to conduct experiments, collect and record experimental data in accordance with the program'.

Course objective 5 is to be able to communicate and interact well with team members. The objective supports the graduation requirement '9.1 Be able to communicate effectively with members of other disciplines and respect the ideas and opinions of others in a team project'.

Course objective 6 is to have an awareness of self-directed learning and to master the methods of self-directed learning. The objective supports the graduation requirement '12.1 Have the awareness of independent learning and lifelong learning, and master the methods and approaches of independent learning'.

4.2   Course Assessment Practice

According to the teaching syllabus, the course '*Big Data System and Technology*' consists of two parts: regular assessment and final assessment, each accounting for 50%. The final assessment is conducted in the form of group project defense, which uses result-oriented assessment, and the regular assessment includes attendance, laboratory and blended teaching performance, which uses process assessment. The specific implementation items and assessment basis are shown in Table 2.

4.3   Objective Achievement Calculation

In OBE, the assessment results of each part of the course can be used to measure the achievement of the course objectives, and the achievement of the professional graduation requirements can finally be calculated through the achievement of the course objectives, fully reflecting the concept of measuring the success of students by the final achievement. '*Big Data System and Technology*' course objective achievement assessment link support table is shown in Table 3.

Table 2. Practice of the assessment system of '*Big Data System and Technology*' course with result orientation [Self-drawn]

Assessment module	Assessment indicators	Assessment basis	Weights
Blended Learning Performance	The number of times of platform login	The number of times a task is posted as a basic login, recorded as 85 points, and will be used as a benchmark and fluctuates up and down	1%
	Platform login time	The total length of the platform video and the set time for completing exercises, assignments and stage quizzes are taken as the basic log-in time, which is recorded as 85 points, and will be used as a benchmark and fluctuates up and down.	1%
	Number of video views	The number of videos posted as the basic video viewing count is recorded as 85 points, and will be used as a benchmark and fluctuates up and down. It is important to notice that for each video to set the effective viewing time, to reach the effective viewing time, before it is recorded as 1 time to watch.	1%
	Questioning and posting communication	Determine the basic number of questions and postings, recorded as 85 points, and will be used as a benchmark and fluctuates up and down	1%
	Group activity participation and attendance	For each discussion, the group will record a summary of the discussion and rate the participation of the group members. Conduct mutual evaluation among class groups and the average of the two is the final score of the indicator	2%

Table 2. (*continued*)

Assessment module	Assessment indicators	Assessment basis	Weights
	Attendance	The number of roll call or sign-in is at least 1/5 of the total number of hours, 10 points will be deducted for 1 missed class, and 4 missed classes will be disqualified from the examination.	4%
	Practice completion	Average score of the exercise	1%
	Homework completion	Average score of homework	2%
	Stage test scores	Average score of the test	2%
	Flipped classroom performance	Each group's discussions, explanations and answers to questions in the flipped classroom are scored in the ratio of 2:3:5 by group, self-evaluation, mutual evaluation and teacher evaluation	2%
Experiment	Completion of the "Hadoop development environment configuration" experiment	Including the completion of experiments and experimental reports, the completion of experiments using student mutual evaluation, experimental reports using teacher evaluation, the ratio of 4:6	8%
	Completion of the "HDFS file access" experiment	As above	8%
	Completion of the experiment "Sentiment discrimination based on Naïve Bayes classifier"	As above	15%

Table 2. (*continued*)

Assessment module	Assessment indicators	Assessment basis	Weights
Final Project Defense	Final Exam Scores	The project defense is conducted in a group format, where the project's environment configuration, upload file function, upload file checking function, code specification, model selection, prediction effect, summary report and defense are considered in a ratio of 10:10:5:5:20:20:10:20	50%

Table 3. Course objective achievement assessment link support table

Graduation requirement index points	Course Objectives	Assessment link	Course Objective Assessment Session Weighting	Course objective weights (for the same graduation requirement indicator)
2.2	Course Objectives 3	Exercise (1)	0.1	1
		Homework (2)	0.1	
		Test(3)	0.2	
		Final Project Defense (4)	0.5	
3.1	Course Objectives 2	Exercise (1)	0.1	1
		Homework (2)	0.1	
		Test (3)	0.1	
		Experiment 2 (4)	0.2	
		Final Project Defense (5)	0.5	
4.3	Course Objectives4	Exercise (1)	0.1	1
		Homework (2)	0.1	
		Test (3)	0.1	
		Experiment 3(4)	0.2	
		Final Project Defense (5)	0.5	

Table 3. (*continued*)

Graduation requirement index points	Course Objectives	Assessment link	Course Objective Assessment Session Weighting	Course objective weights (for the same graduation requirement indicator)
5.1	Course Objectives 1	Experiment 1(1)	0.4	1
		Final Project Defense (2)	0.6	
9.1	Course Objectives 5	Group activity participation and attendance	0.3	1
		Flipped classroom performance	0.3	
		Final Project Defense	0.4	
12.1	Course Objectives 6	The number of times of platform login	0.1	1
		Platform login time	0.1	
		Number of video views	0.1	
		Questioning and posting communication	0.2	
		Attendance	0.2	
		Final Project Defense	0.3	

5   Conclusion

OBE is a new educational paradigm that emphasizes the identification of expected learning outcomes for students, the way to reach and the evaluation of attainment, and is playing an increasingly important role in the development of student competence. In the context of strongly promoting the teaching reform of higher education, with the development of information and communication technology, the online and offline blended teaching mode has received wide attention and has been practiced in the courses of different majors. Therefore, exploring the result-oriented course assessment system under the blended teaching mode plays an important role in scientifically and objectively evaluating students' learning effects, strengthening the understanding and mastery of knowledge, enhancing students' interest and ability in independent learning, achieving the intended knowledge, ability and value objectives of the course, and thus improving the quality

of talent training. Of course, it is also necessary to notice that the course assessment under the blended teaching mode has a close relationship with disciplines and courses, which requires the design of different assessment indexes and methods according to the characteristics of different disciplines and courses.

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