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Construction and Practice of an Evaluation System for the Achievement of Hybrid Teaching Goals from the Perspective of Ubiquitous Learning

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Abstract: With the popularization of ubiquitous learning technology, the teaching mode in colleges and universities has transformed to the in-depth integration of online and offline. Blended teaching has become the core path of first-class curriculum construction and classroom reform. The traditional evaluation of curriculum goal achievement has problems such as lack of process data, single quantitative method and vague result presentation, which is difficult to meet the needs of teaching evaluation in the ubiquitous learning scenario. Based on the OBE concept, this paper builds a whole-process teaching goal monitoring system relying on the intelligent teaching platform. Through multi-dimensional index screening, scientific weight assignment, real-time data collection and visual presentation, a practical, traceable and optimizable evaluation model of blended teaching goal achievement is constructed. The application effect is verified combined with curriculum practice, providing a reference for the accurate evaluation and continuous improvement of blended teaching quality in colleges and universities.

Keywords: Ubiquitous Learning; Blended Teaching; Teaching Objectives; Achievement Evaluation; OBE Concept; Data Visualization

1. Introduction

Ubiquitous learning has broken the constraints of time and space on learning behaviors, allowing learners to access learning resources and participate in teaching interactions anytime and anywhere through smart terminals. This feature has directly driven the blended teaching model to become the mainstream mode of teaching reform in higher education institutions. The Ministry of Education of China's "Double Ten Thousand Plan" explicitly includes online and offline blended courses in the category of first-class courses, highlighting the significant role of blended teaching in talent cultivation. Currently, a large number of studies have been conducted on the blended teaching model, implementation paths, and quality evaluation, but there are still obvious shortcomings in research focusing on the achievement of teaching objectives in higher mathematics: most evaluations are based on final exam scores as the core basis, ignoring process data such as pre-class preview, in-class interaction, and post-class extension; some studies' constructed indicator systems remain at the theoretical level, lacking platform support and practical verification; evaluation results are mainly presented in textual descriptions, making it difficult to achieve intuitive and visual presentation. Against this backdrop, establishing a full-chain achievement evaluation system covering "objective decomposition - process monitoring - data calculation - result feedback - continuous improvement" based on the ubiquitous learning scenario and integrating information technology with the teaching process has become a key task for improving the quality of blended teaching and perfecting the teaching evaluation mechanism.

2. Relevant Research and Literature Exploration

Ubiquitous learning, with its characteristics of "anyone, anytime, anywhere", has promoted blended teaching to become an important teaching model in higher education. Constructing a scientific evaluation system for the achievement of teaching objectives has become the key to bridging teaching practice and the demands of talent cultivation. Scholars have conducted extensive research on this issue, generating a wealth of research results.

At the theoretical research level, scholars often rely on constructivism, the OBE concept, and

other theories to clarify the core orientation of the evaluation system. In early studies, Li F, et al. (2016) proposed that micro-lectures are suitable for the characteristics of ubiquitous learning, providing a basic idea for the evaluation of blended teaching [1]; Lin et al constructed a preliminary framework for the evaluation of higher mathematics teaching based on engineering education accreditation standards [2]; Wang emphasized the need to combine course teaching with quality monitoring and feedback evaluation, providing a theoretical reference for the construction of an evaluation loop [3]. In the past two years, related theoretical research has been further deepened. Gudo et al. through a systematic review, identified six core themes of blended teaching evaluation, providing an international perspective for the construction of the evaluation system [4]; Wang et al. combined the BOPPPS teaching model and proposed a reform path for higher mathematics evaluation under the background of engineering education accreditation [5]; Zheng et al. based on the OBE concept, improved the implementation path of blended teaching evaluation [6], further enriching the theoretical connotation of the evaluation system.

In terms of the construction of the evaluation system, scholars have formed a multi-dimensional exploration pattern. Liu and Yang combined information technology to provide an example of the construction of a group of engineering mathematics courses, offering a reference for the design of evaluation indicators [7]; Meng et al. utilized teaching big data to explore personalized evaluation models [8]; Peng et al. through interdisciplinary teaching practices, improved the evaluation dimensions [9]; Lin integrated mathematical modeling competitions to optimize the ability evaluation indicators [10]. In the past two years, research has placed more emphasis on technology empowerment and practical adaptation. Wei et al. constructed a four-dimensional evaluation ecosystem empowered by digital intelligence, achieving the dynamicization of the entire evaluation process [11]; Zhang et al. based on the AI+POPBL model, built a four-dimensional dynamic evaluation model covering knowledge, skills, and values [12], effectively enhancing the operability of the evaluation system; Harrison et al. emphasized the importance of technology integration and teacher support in the evaluation system [13], addressing the shortcomings of technology-integrated evaluation.

In practical application research, existing achievements have demonstrated the value of the evaluation system while also exposing many problems. For instance, some teachers have a misunderstanding of blended teaching, leading to the inadequate implementation of evaluation indicators; the collection of evaluation data lacks efficient technical support, making it difficult to comprehensively reflect the achievement of objectives; most studies have not formed a "evaluation-feedback-optimization" loop, and digital intelligence evaluation faces new problems such as insufficient technology integration. It is necessary to combine the technical characteristics and demands of ubiquitous learning, strengthen the deep integration of the evaluation system with teaching practice, improve the data-driven mechanism, and promote the evaluation system to truly serve the optimization of teaching objectives and the improvement of talent cultivation quality.

3. Construction of an Evaluation System for the Achievement of Hybrid Teaching Goals

3.1 Principles of the Evaluation System Design

The design principles of the evaluation system mainly include the following four principles: (1) Outcome-oriented principle: Taking the graduation requirements for talent cultivation as the top-level basis, the course objectives are decomposed layer by layer to chapters, knowledge points and teaching activities. (2) Full-process coverage principle: Integrating data from all links before, during and after class to avoid “emphasizing results over processes”. (3) Quantifiable and operable principle: The selection of indicators takes into account both scientificity and practicality, and automatic collection and calculation are realized through the platform. (4) Continuous improvement principle: Evaluation results are directly fed back to the teaching process to support dynamic adjustment of teaching strategies.

3.2 Dimensional Division of Teaching Objectives

Following the OBE concept, the teaching objectives of the course are divided into four dimensions to ensure a complete and implementable objective system. They mainly

include the following four dimensions of objectives: Knowledge objective - the degree of students' mastery and application of core concepts, principles and methods; Ability objective - comprehensive abilities such as autonomous learning, collaborative exploration, problem-solving and innovative thinking; Quality objective - comprehensive qualities such as scientific spirit, humanistic quality, professional norms and responsibility awareness; Ideological and political objective - educational requirements such as value guidance, patriotism, professional ethics and social responsibility.

3.3 Evaluation Indicators and Weight Determination

Through literature analysis, expert consultation, and teaching team discussions, an initial pool of indicators was drafted. Redundant indicators were eliminated using principal component analysis, and the weights of each dimension and specific indicators were determined using the Analytic Hierarchy Process (AHP). The final evaluation system consists of 4 first-level indicators, 12 second-level indicators, and N third-level observation points.

3.4 Goal Decomposition and Matrix Construction

Establish a goal matrix for the course and chapters: with the overall course goal as the row and the chapters as the columns, set the contribution weights of each chapter to the course goal, with the sum of all chapter weights equal to 1. Establish a goal matrix for the chapters and activities: with the chapter goals as the rows and teaching activities as the columns, set the weights of activities such as previewing, testing, assignments, and extracurricular expansion to the chapter goals, with the sum of all activity weights equal to 1. Through a double-layer matrix, the course goals are progressively implemented to chapter goals and then to teaching activities, providing a basis for the calculation of achievement.

4. Implementation Path of Evaluation Based on the Smart Teaching Platform

Firstly, a unified course resource package is constructed based on the smart teaching platform, including micro-lesson videos, electronic textbooks, supplementary materials, question banks, interactive tasks, etc., to achieve resource sharing among different classes of the same course and ensure fairness in learning. Teachers can directly use the resource package to conduct teaching, and students can complete tasks such as previewing, testing, and discussion through mobile terminals. The platform automatically records learning behavior data. Secondly, a full-process quality monitoring system is constructed: including basic information configuration: inputting course information, teaching team, course objectives, weight matrix, etc., to complete system initialization. Thirdly, process data collection is carried out. Automatically collect data such as pre-class preview completion rate, video viewing duration, classroom interaction score, homework completion quality, test scores, group task results, etc. Finally, the platform automatically calculates the achievement rate and generates dynamic data reports, achieving data visualization presentation. The results are displayed in forms such as radar charts, bar charts, and trend charts to present the achievement rates clearly and intuitively, reflecting the corresponding learning outcomes. Taking the second semester of the 2024-2025 academic year as an example, the monitoring system of the teaching platform provided the achievement rate and activity situation of the blended teaching, as shown in Figure 1 and Figure 2.

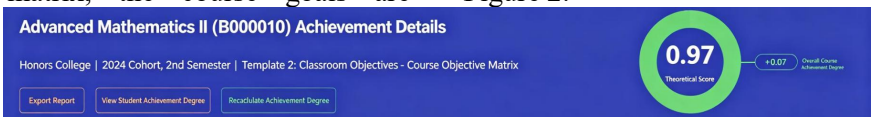

Figure 1. Achievement of Teaching Objectives for "Advanced Mathematics II".

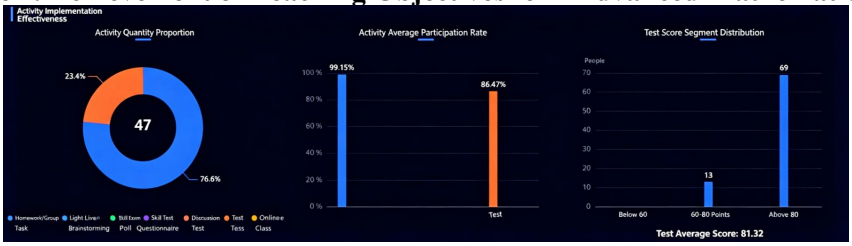

Figure 2. The Activity Portrayal of Advanced Mathematics II.

During the teaching process, the quality of the advanced mathematics course needs to be monitored and evaluated in real time. It is necessary to promptly understand the teaching situation of the teachers and the learning status of the students. Generally, data for each period, such as video learning data, non-video resources like PPT and homework answers, homework scores, unit test scores, and the learning situation of extension tasks, should be statistically analyzed. In teaching, real-time feedback data generation generates warning alerts for achievement levels. For goals below the threshold, teachers can promptly urge students to complete learning tasks and provide personalized tutoring. The teaching team conducts collective discussions based on the data, optimizes the design of teaching activities, adjusts teaching methods, and forms a closed-loop management of monitoring, feedback, and improvement. Through three rounds of teaching reforms, students' learning enthusiasm and learning outcomes have undergone significant changes. Their competition scores and postgraduate entrance examination scores have improved significantly, and their evaluation of the subject and satisfaction with teaching have also increased significantly.

5. Practical Results and Reflections

Taking advanced mathematics as an example, three rounds of teaching practice were carried out. The results showed that the overall achievement of the course's goals increased from 83% to 97%, and the achievements in terms of knowledge, ability, quality, and ideological and political education all improved significantly. In terms of course evaluation, a combination of formative evaluation and summative evaluation was adopted. The overall course evaluation score includes both the regular assessment score and the final exam score. The regular assessment score includes the evaluation of students' learning outcomes and their participation in the learning process. The cloud class score and the regular assessment score are the main reference basis. The calculation of the regular assessment score includes attendance score, homework score, regular test score, and regular performance. Among them, regular performance includes performance inside and outside the classroom, learning situation of course resources, and extracurricular extension tasks, etc. This part is determined by each instructor based on the actual teaching situation. Overall, students' learning initiative has increased, and the completion rate of pre-class study, classroom interaction rate, and homework submission rate have all improved. The abstract ideological and political and quality goals have been presented in a data form, providing an objective basis for teaching evaluation.

However, there are also certain problems in the teaching process. The initialization of the system and the configuration of the target matrix are relatively complex, and they require certain requirements for teachers' information technology operation capabilities. Once the chapter goals are activated, they cannot be modified, making it difficult to adapt to the dynamic adjustment needs in the teaching process. In online learning, the effect of autonomous learning depends on the students' self-awareness, and the platform only records the viewing behavior, making it difficult to accurately judge the depth of learning. The scoring of group cooperative tasks is greatly influenced by the group leader, and the process scoring standards need to be further refined.

6. Conclusion

Under the background of ubiquitous learning, the evaluation of the achievement of mixed teaching goals needs to shift from outcome evaluation to data-driven evaluation throughout the entire process. Based on the OBE concept and the intelligent teaching platform, this paper constructs an evaluation system with clear goal decomposition, comprehensive process monitoring, precise data calculation, and visualized results, enabling the quantification, traceability, and improvement of teaching goal achievement. This system not only enhances the scientificity and objectivity of mixed teaching evaluation but also provides a replicable practical path for university teaching quality monitoring, continuous course improvement, and the construction of first-class courses. In the future, it can further integrate artificial intelligence and big data technologies to achieve personalized achievement evaluation and precise teaching push, promoting the development of mixed teaching towards higher quality.

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