International Conference on Modern Education, Humanities and Art (MEHA2024)

Construction and Implementation of a Data-Driven Blended Learning Model

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Abstract: This study focuses on the reform needs of the current online and offline blended teaching mode, and takes the blended teaching of the "Java Language Programming" course as the specific research object. With the help of information technology teaching platforms and intelligent teaching tools, a blended teaching mode based on educational big data is constructed. This model is based on the multidimensional information of curriculum teaching, through the collaborative promotion of curriculum knowledge mapping and teaching data analysis, the development of teaching strategies, the design of teaching paths, the implementation of teaching monitoring and intervention and other teaching measures, to help learners build a learning atmosphere of autonomous learning and cooperative exploration, and effectively complete the knowledge construction. The implementation of teaching models has a certain positive effect on improving the effectiveness of blended teaching, and can provide reference and reference for existing blended teaching designs.

Keywords: Education Big Data; Blended Learning; Teaching Model; Knowledge Map

1. Introduction

With the development of the Internet, artificial intelligence and education big data analysis technology, under the new ecological environment of education informatization, information technology will promote the further integration of education big data and education teaching practice, and change the traditional teaching mode, which has become an inevitable trend of China's higher education reform. Online-offline hybrid teaching has become the main breakthrough to solve the traditional teaching contradictions, promote the teaching reform in colleges and universities, and improve the quality of teaching. However, there are still certain problems with online-offline blended teaching. For example, the effect of online independent learning is uneven [1], resulting in inconsistent mastery of students; offline teaching lacks in-depth communication, and the participation of some students is low.

Some researchers argue that modern information technology teaching is no longer purely empirical; it must be data-driven. There are still many problems to be solved in combining information technology and course teaching, maximizing the advantages of information technology to improve teaching and enhancing the effectiveness and precision of blended teaching. Through the information technology teaching platform, accurately grasping the feedback data of learners; implementing personalized teaching design and guidance for the development level of learners; using big data analysis to improve the blended teaching mode and building an efficient and intelligent blended teaching classroom is bound to become a new trend in the development of blended teaching in the future.

2.Theoretical Foundations

2.1 Big Data in Education

Big data in education refers to big data about education, which is a subset of big data research. Big data in education encompasses data generated and collected during the teaching and learning process. The sources of educational big data mainly include data in classroom teaching, data in teaching management, and data in teaching research. The main educational big data studied in this research includes a variety of learning behavior data directly generated in the daily teaching and learning process.

Educational big data has the characteristics of

multi-stage, multi-dimensional, diversity, and high complexity. By reasonably collecting and analyzing these data, it is possible to accurately analyze the status of learners, promote personalized teaching and learning, and make teaching evaluation comprehensive and effective, which improves the teaching quality monitoring system and ensures the scientific nature of teaching decisions.

2.2 Blended Learning Models

Blended learning is the combination of network learning and traditional classroom teaching. It not only highlights the main role of students, but also fully reflects the leading role of teachers in the teaching process, so that students can truly become the protagonist in their studies. In the previous research of educational technology, the concept of blended learning and blended teaching is relatively close. The difference is that blended teaching emphasizes the dominant position of teachers. Blended teaching is from the perspective of teachers' teaching, considering how teachers adjust teaching strategies and adopt appropriate teaching methods to achieve the best teaching effect.

By consulting the relevant literature of blended learning and blended teaching mode, combined with the relevant concepts of Shengquan Yu, Qiliang Zhang and other famous scholars, the blended teaching mode is "a teaching strategy that can help students form or improve a certain skill, provide appropriate resources or activities related to the situation, and achieve the optimal teaching effect through the appropriate information media and in the appropriate period of time".

3. Data-Driven Blended Learning Model Based on

3.1 Model Construction

The blended teaching mode is based on an information-based teaching platform, which constructs a curriculum knowledge map, collects multidimensional teaching data and conducts learning situation analysis, so as to prepare for personalized tiered teaching and precise teaching in teaching. The model is guided by constructivist learning theory, and designs teaching strategies, teaching methods and teaching steps with students as the center and teachers as the leaders. At the same time, with the help of a series of smart education initiatives such as adaptive resource recommendation, learning path planning, curriculum alert and intervention provided by the information technology teaching platform, it builds a learning environment for students to learn independently and collaboratively explore, and helps students to more effectively achieve the construction of knowledge meaning [2]. The core of the model is driven by curriculum knowledge mapping and educational big data in a collaborative manner, thus promoting students' personalized education and development. The data-driven blended teaching model is shown in Figure 1.

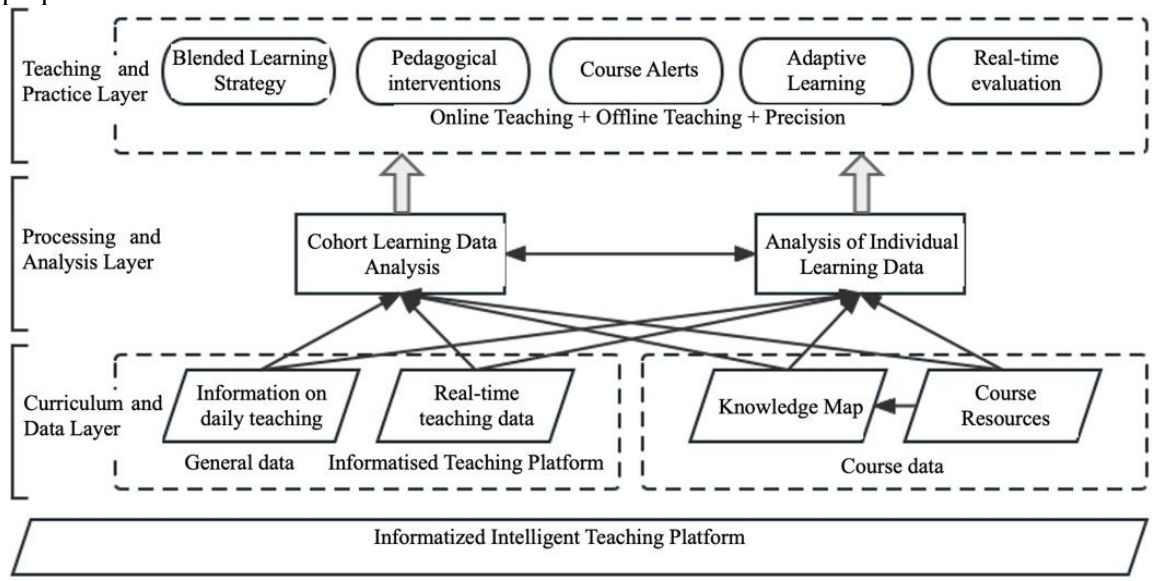

Figure 1. Data-Driven Blended Teaching and Learning Based Model

With the support of information teaching platform, the hybrid teaching mode is

composed of three levels: curriculum and data layer, processing and analysis layer, and teaching and practice layer. The course and data layer includes online course teaching resources, course knowledge map, routine teaching data and real-time teaching data recorded by the information teaching platform; In the processing and analysis layer, the intelligent teaching tools provided by the information teaching platform analyze the group learning data and individual learning data; According to the analysis results provided by the processing and analysis layer, the teaching and practice layer designs hybrid teaching strategies, implements teaching intervention, course warning, adaptive learning and real-time evaluation, and realizes hybrid precision teaching online and offline.

3.2 Classification, Collection and Processing of Data

The organic integration of information technology and education and teaching has brought significant changes in the carrier, storage, transmission, presentation, reception and application of teaching information generated in the teaching process. The information-based teaching platform can record and collect data of various types, structures and dimensions generated in the teaching process, which can comprehensively reflect the situation of different aspects in teaching.

The teaching data collected by the information-based teaching platform can be divided into three categories according to students, teachers and teaching management, namely, students' learning data, teachers' teaching data and teaching management data. Students' learning data includes students' basic data, learning behavior data, learning evaluation data and students' emotional data; Teachers' teaching data includes teachers' basic data, teaching behavior data, teachers' evaluation data and teachers' emotional data [3]; Teaching management data includes class management data, teaching supervision data, teaching research supervision data and class observation and evaluation data. Through the mining and analysis of these teaching data, we can more accurately understand the rules of classroom teaching, improve teaching design, and improve teaching quality.

From other dimensions, teaching data can be divided into group data and individual data, static historical data and dynamic real-time data, stage data and questionnaire survey data. Group data can be used to analyze the overall learning situation of students, while individual data is mainly used to analyze the learning behavior characteristics and learning situation of individual students; Static historical data (such as students' basic situation, historical scores, etc.) is suitable for mining and discovering teaching laws and trends at the macro level. Dynamic real-time data can reflect students' current learning situation and problems, and is an important basis for personalized teaching. Stage data such as learning time and online unit test can reflect the completion of learning tasks, stage learning achievements and learning efforts of students in stage learning. The questionnaire survey data can reflect the information of students' psychological tendency, life goals and internal learning motivation [4], which can help teachers improve and adjust teaching methods and strategies according to needs.

In a word, these teaching data describe the behavior and activity process of teaching and learning from multiple dimensions, as well as the operation status of the teaching system and students' learning achievements. These data provide a comprehensive basis for analyzing and improving the process of education and teaching. Using education data mining technology to model, analyze and process the education data collected based on the information platform in mixed teaching can expand the dimension and depth of teachers' understanding of the teaching classroom, facilitate the analysis of learning situation, grasp the learning status of students, optimize the teaching process based on data, make more scientific and reasonable teaching decisions, and truly realize information-based teaching[5].

3.3 Building a Knowledge Map of the Curriculum

Curriculum knowledge mapping is the basis of data collection and Analysis on information teaching platform. At the same time, without the map of curriculum knowledge, personalized services such as intelligent question answering system and Learning Resource Recommendation of information teaching platform cannot be realized. The basic component of the curriculum knowledge

map is the curriculum knowledge points. According to the logical relationship between the knowledge points and the curriculum teaching objectives, the information such as the classification of knowledge points and the requirements of cognitive dimensions is added to form a curriculum knowledge network and can be visualized. The visualized knowledge map can mark and record learners' learning of course knowledge points, form learners' cognitive map, and can also be used for knowledge navigation, learning effect evaluation, learning content recommendation and other services of information-based teaching platform to meet the diversified needs of intelligent teaching [6].

Taking the course 'Java programming' as an example, when constructing the knowledge map of the course, we first clarify the knowledge domain and scope of the course, and extract the knowledge units and their hierarchical relationships from the teaching materials such as course textbooks, syllabus, lesson plans and courseware according to the principles of systematicity and hierarchy based on the knowledge system and structure of the course [6] and chapter, section and point levels. hierarchical relationships [7], and divide and summarize the knowledge points according to the levels of chapters, sections and points. In the extracted knowledge points of the course, the manual mode is used to divide the knowledge points into up to seven levels according to the chapter system of the course teaching; the relationship between the knowledge points is divided into three kinds of knowledge points, which are the antecedent knowledge points, the posterior knowledge points and the correlation knowledge points, to determine the correlation degree and the antecedent relationship between two knowledge points, and there can only exist one of the three kinds of relationship between any two knowledge points. Thus, the correlation diagram of knowledge points is constructed.

Then, based on Bloom's Classification of Educational Objectives to clarify the classification of the course knowledge points and add labels to the knowledge points, the knowledge points in the course knowledge map are classified into four types: factual, conceptual, procedural, and metacognitive knowledge, and at the same time, the cognitive dimensions of the knowledge points are classified into six dimensions: remembering, understanding, applying, analyzing, evaluating, and creating, and in accordance with such classification and cognitive dimensions of the knowledge points are Labelling.

Finally, the constructed knowledge graph is verified and corrected to ensure its accuracy and completeness. The content of the constructed knowledge map is imported into the information technology teaching platform to generate the course knowledge map[8].

In addition, it is also necessary to mark teaching resources on the teaching platform in order to associate them with the corresponding knowledge points in the knowledge map. Therefore, the construction of curriculum knowledge map needs to comprehensively use a variety of technical means, and pay attention to the semantic relationship and hierarchical structure between knowledge points and concepts, so as to improve the readability and comprehensibility of knowledge.

4. Implementation of the Blended Learning Model

Based on the implementation of the hybrid teaching mode of education big data, Superstar Learning Platform is selected as the information-based teaching platform to build the course. According to the three-tier structure of the teaching mode, the first layer of courses and data layer are built on the teaching platform. The main task of this step is to build online courses, including the construction of various teaching resources and curriculum knowledge map. The second layer of data processing and analysis directly uses the corresponding intelligent teaching and data analysis tools provided by the platform. The third level of teaching and practice, that is, the implementation of the teaching mode needs to be based on the construction of the first two levels.

This study divides the implementation of blended teaching into four stages: online independent learning, offline internalization and absorption, discussion and dialogue, and learning evaluation. Through the implementation of these four teaching phases, students are able to gradually improve their mastery of what they have learnt, from memorizing and understanding to applying, analyzing and even creating, as shown in Figure 2.

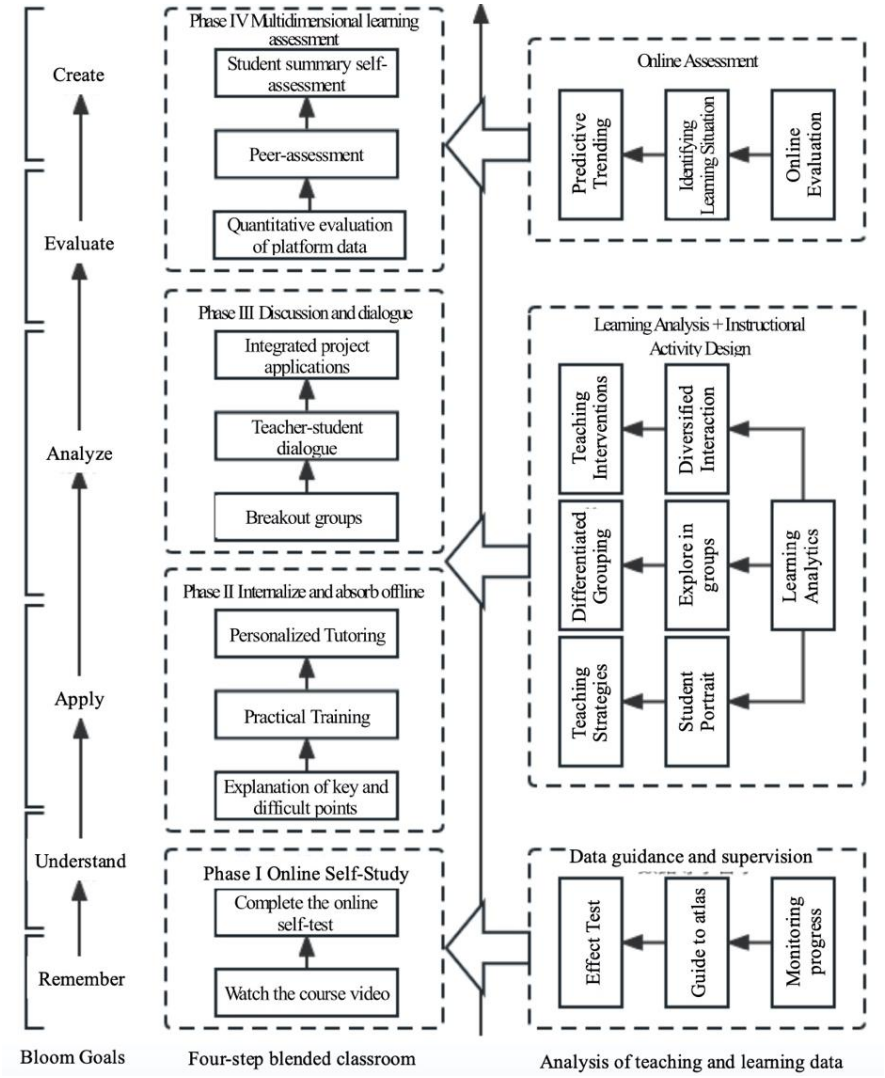

Figure 2. Data-Driven Blended Instructional Design

4.1 Online Autonomous Learning Stage

In this learning stage, students need to watch the course video and complete the corresponding online learning tasks to understand and remember the knowledge they have learned; At the same time, students can strengthen the consolidation of knowledge points through online self-test and unit knowledge map. Teachers can monitor students' learning progress by counting the video viewing rate through the learning platform. According to the statistical results of self-test error rate, teachers can mine students' high-frequency errors and learning difficulties, and design corresponding supervision measures and teaching strategies.

4.2 Offline Internalization and Absorption Stage

Offline teaching can further deepen students' understanding of knowledge and reach the application level. The main task of offline teaching is to help students break through the key and difficult points in learning, so as to realize the internalization and absorption of knowledge. In the offline internalization and absorption stage, according to the online learning data and pre-test data of middle school students on the information teaching platform, face-to-face teaching and practical training are combined. For the common problems of most students, teachers can teach collectively; For the personality problems of a few students, individualized guidance can be carried out in the process of training. In this way, help students gradually systematize the fragmented knowledge they have learned, make the knowledge in students' minds complete the evolutionary process from point to surface, and then expand from surface to network, and realize the teaching goal of

internalization and absorption of knowledge [9].

4.3 Discussion Dialogue Extended Learning Stage

Based on the results of learning situation analysis, for students at different levels, inquiry group learning and discussion of "homogeneity between groups and heterogeneity within groups" can be implemented. Within the group, students can share, correct and improve their thinking path. Through communication, they can not only find problems, abstract problems, express problems and solve problems, but also exercise and improve their thinking ability. Peer discussion can enable students to constantly produce errors and reveal errors in the process of learning, and find and correct errors in the conflict of views and thoughts, so as to make the truth more clear.

In addition, teachers should also participate in students' group discussions and conduct targeted teacher-student dialogues based on the results of the discussions. The purpose of student group discussion is to solve low-level problems and refine high-level problems; The teacher-student dialogue is mainly for teachers to answer questions in order to solve high-level problems. Discussion and dialogue can help students learn to analyze and evaluate.

4.4 Multidimensional Learning Evaluation

The learning data full process recording and data analysis function provided by the information-based teaching platform can truly realize diversified process evaluation and improve the comprehensiveness and accuracy of learning evaluation. The information-based teaching platform can count students' learning progress, test scores, homework completion, class attendance, classroom interaction and other aspects of data, and incorporate them into the process of learning evaluation. Through these evaluation data, teachers can clearly understand whether students have completed the learning task and whether they have mastered the knowledge points[10]. At the same time, teachers can feed back these evaluation data to students in time to promote learning through evaluation. In the classroom, online thematic discussion and offline group discussion can use smart teaching tools to implement various evaluation methods such as self-evaluation and peer evaluation, and encourage students to actively participate in teaching activities.

5. Conclusions and Recommendations

It is an effective way to improve the quality of teaching to carry out blended teaching based on the analysis of teaching data and improve the blended teaching mode and teaching strategies by analyzing students' learning data.

Learning analytics based on big data in education can help optimize blended instructional design and improve teaching effectiveness. The learning data in the smart teaching platform helps to improve the teaching evaluation and improve the accuracy of teaching. The teaching tools provided by the information smart teaching platform help teachers carry out various teaching activities and carry out synchronous learning situation analysis, and promote the interaction between teachers and students in teaching.

In mixed teaching, the role of teachers is no longer the designer, organizer and evaluator in the traditional classroom, but also the listener, mentor and feedback of students. Therefore, teachers need to pay attention to cultivating their diversified teaching skills. At the same time, schools should also strengthen the professional training of teachers' information teaching.

Acknowledgments

This paper is supported by the research of Shanxi Province 2023 special topic of vocational education theory: technology-enabled vocational education online and offline integration teaching mode research (Project No.: SXSZJS2023SX0042), and the general topic of Shanxi Province 2022 general topic of the '13th Five-Year Plan' for educational science: 1+X-oriented Python development-related course construction research (Project No.: GH-220794).

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