Article

Exploration and Practice of Online-Offline Blended Teaching Mode for Statistics Courses in the Digital Age-Based on the BOPPPS Model

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Abstract: With the rapid development of the digital age, the traditional teaching mode of statistics course faces new challenges and opportunities. In the actual teaching process, traditional teaching methods will not be able to achieve the multiple teaching objectives of the course. Therefore, under the background of digital era, the teaching mode needs to combine diversified teaching means and teaching methods. Based on the BOPPPS teaching model, this paper explores the practice and application of online and offline hybrid teaching mode in statistics courses. The study shows that the blended teaching mode combining statistical analysis software such as EXCEL and SPSS and based on BOPPPS can effectively stimulate students' learning initiative, promote the deep integration of the theory and practice of statistics, and provide a reference path for the transformation of digital education.

Keywords: digital age; statistics; BOPPPS model; hybrid online and offline

1. Introduction

With the rapid development of digital technology, the informatisation of education has become an important focus of reform in higher education. As a discipline that emphasises both theory and practice, the teaching mode of Statistics urgently needs to adapt to the demand for digital learning in order to enhance students' data analysis ability and innovative thinking. However, the current Statistics course in colleges and universities still commonly adopts the traditional lecture mode, which is difficult to meet the requirements of personalised learning and higher-order ability cultivation due to the problems of single teaching method, insufficient student participation, and insufficient integration of online and offline resources [1]. In this context, exploring a new teaching model has become essential for reforming statistics teaching.

As a student-centred instructional design framework, the BOPPPS model emphasises goal orientation and interactive participation. Based on this model, this paper explores the construction and implementation of an online-offline blended teaching approach for statistics courses. By analysing the limitations of traditional teaching methods, designing a three-phase blended teaching programme consisting of pre-class, in-class and post-class phases, and verifying its implementation effect through specific case studies, we aim to provide a reference experience for reforming statistics teaching and innovating teaching methods in universities in the digital era. The programme is designed to provide a reference experience for the reform of statistics teaching, while also providing a reference for the innovation of teaching modes in universities in the digital era.

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2. Analysis of the Current Situation of Traditional Statistics Teaching Methods

Statistics is a basic compulsory course for economic majors, a methodological discipline for collecting, processing and analysing data, and it is also a core course for all majors in economics and management. In the era of data science, the training of economic talent is characterised by obvious cross-disciplinarity. Statistics plays an important role in training data scientists in the new era. In order to collect, define and mine massive amounts of data, we need not only the specialised knowledge of computing science, such as data structures and databases, but also the theoretical knowledge of statistics, such as data definition and design. Therefore, statistics plays a cross-influential role in data capture, analysis and mining. Cross-disciplinary training is therefore an important feature of the statistics discipline's talent training model in the big data era, and is of great significance to the future career development of economics majors [2]. However, the traditional teaching method can no longer meet the multiple learning objectives of this course. There are three issues in the teaching process of the statistics course that need to be addressed.

2.1. Monotonous Teaching Methods Fail to Adapt to the Needs of Digital Learning

In the Statistics course, the traditional teaching method is used more often in the teaching process. This teacher-centred method has obvious limitations. Firstly, it relies too heavily on classroom knowledge transfer, ignoring students' subjectivity and the cultivation of their practical abilities. This leads to insufficient classroom interaction and low motivation to learn. Secondly, the passive learning mode inhibits the development of critical thinking, which is not conducive to developing innovative abilities. In addition, statistics is a practical discipline that requires students to master not only basic theories, but also practical skills such as data collection, processing, analysis and visualisation. This is especially important in the era of big data, yet the traditional teaching mode is clearly inadequate for cultivating these core competencies in students. Visualisation and other practical skills are essential in the era of big data, yet the traditional teaching mode is insufficient for cultivating these core competencies in students. Therefore, there is a significant gap between this teaching method and the demand for statistical talent in the digital era.

2.2. Fragmented Integration of Online-Offline Teaching Resources Constrains Synergistic Outcomes

In the era of big data, digitalisation has permeated all aspects of politics, the economy, culture and daily life, reshaping the landscape of education. Nevertheless, Statistics courses still rely on traditional teaching methods, primarily PowerPoint presentations supplemented by Learning Management Systems. This affects students' enthusiasm for learning and makes it difficult for them to engage with theoretical knowledge, resulting in low motivation and initiative. In particular, mastering theoretical knowledge is passive and students find it difficult to apply statistical principles to analyse data. Data processing and analysis has also become an important part of statistics, with a variety of data analysis software continuing to emerge. Students' practical performance with statistical software such as SPSS, EViews and Python is weak. Furthermore, machine learning and data mining continue to develop, but the teaching of statistics lags behind the industry's development. Therefore, statistics teaching in the context of big data should also keep pace with the times, with teaching content and methods reflecting the characteristics of the big data era.

2.3. Disconnection between Ideological-Political Education and Disciplinary Courses in Colleges and Universities

With the advancement of society, various complex social issues and ethical and moral dilemmas are emerging. In order to enable students to correctly analyze problems, judge

right and wrong, and develop a sound outlook on life and values in the face of these challenges, the teaching of social responsibility and ethics should be regarded as an important task. Statistics mainly cultivates students' application ability, innovation ability and practical ability to engage in statistical work, and at the same time requires students to have a strong spirit of patriotism, good professionalism and morality, as well as a correct outlook on life, values and sense of social responsibility [3]. However, in the actual teaching process of the course, the Civic and Political elements are less integrated, and the teachers lack the ability and awareness to fully explore the characteristic Civic and Political elements according to the course content and objectives.

3. The Construction of Online and Offline Hybrid Teaching Mode Based on BOPPPS

The BOPPPS teaching model is characterised by its student-centred philosophy and standardised workflow. It prioritises stimulating students' proactive engagement in the classroom [4]. This study designs a BOPPPS-based instructional framework for statistics courses, implementing a three-phase structure with the seamless integration of ideological and political elements. Through this approach, students will master core knowledge while developing metacognitive competencies, specifically in problem identification, analytical reasoning and solution design, ultimately achieving autonomous learning capabilities. The pedagogical architecture is schematised in Figure 1.

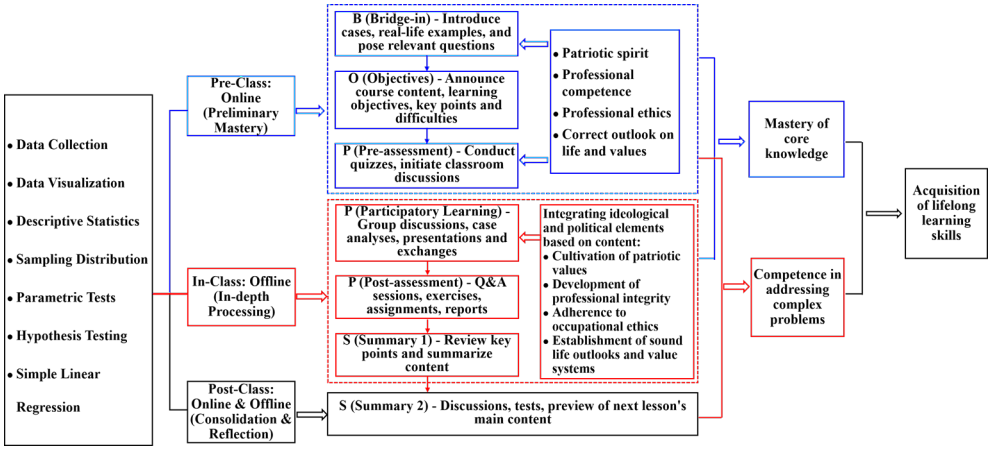

Figure 1. Pedagogical Architecture for the Statistics Course.

Pre-Class Preparation. Firstly, the teacher will release the learning task in advance. Students preliminarily grasp core knowledge points by watching expert lecture videos or reading high-quality articles. Secondly, course content is introduced through case studies, real-life statistical examples, or question-based scenarios. Then, introduce the learning objectives and key points of the lesson so that students can understand the learning focus. Finally, a pre-assessment in the form of a quiz, discussion or Q & A will be conducted to assess students' understanding of the key points and provide a basis for the course. During the introduction or pre-assessment stage, teachers can incorporate elements of civics and politics into the classroom content to cultivate students' patriotism, professionalism, morality and correct outlook on life and values.

In-Class Implementation. This phase employs offline classroom teaching for deep knowledge processing, supplemented by practical tools including Learning Management System, Excel, and SPSS. Adhering to the principle of "Student-Centered Learning with Teacher-Led Scaffolding", the pedagogy integrates group discussions, questionnaire surveys, software hands-on practice, and presentation exchanges to foster multi-dimensional engagement, thereby enhancing communication skills and hands-on competencies. Subsequently, ideological-political elements are embedded to elevate course content to dimensions of legal consciousness and ethical awareness. During the post-assessment phase,

instructors evaluate learning objective attainment through Q & A sessions, short quizzes, case study analysis, class presentations, or practical operations. Finally, instructors consolidate core knowledge points through summarization while conducting teaching reflection for continuous pedagogical enhancement [5].

Post-Class Activities. Instructors release learning materials for the next session via the Learning Management System or class communication platforms, while concurrently conducting online tutoring to address student queries in a timely manner.

4. Conclusion and Analysis of Implementation Outcomes for the Blended Teaching Mode

Statistics is a compulsory foundational course for economics majors, having cumulatively trained over 1000 students. The Learning Management System has recorded over 50,000 course activities, with student engagement exceeding 1000 interactions in the classroom, which demonstrates high participation. Through iterative refinement, the course has achieved the following outcomes.

4.1. Enhanced Learning Outcomes via Multidimensional Evaluation System

The course has reformed conventional assessment methods by adopting a formative assessment approach focused on evaluating students' practical abilities. This course's process assessment is mainly divided into four modules. Module 1 focuses on the survey programme design and is worth 20 points. It examines the objectives, target population, content scope, methodology, and implementation schedule. Module 2 focuses on the implementation of the survey and is worth 15 points. This module examines students' team collaboration skills and their ability to organise and implement the survey. Module 3 focuses on students' ability to analyse data and software applications, as well as the application value of the selected topic, and is worth 50 points. Module 4 is the final defence, worth 15 points. This module mainly examines students' logical thinking, language expression, and ability to think on their feet during the reporting process (Figure 2).

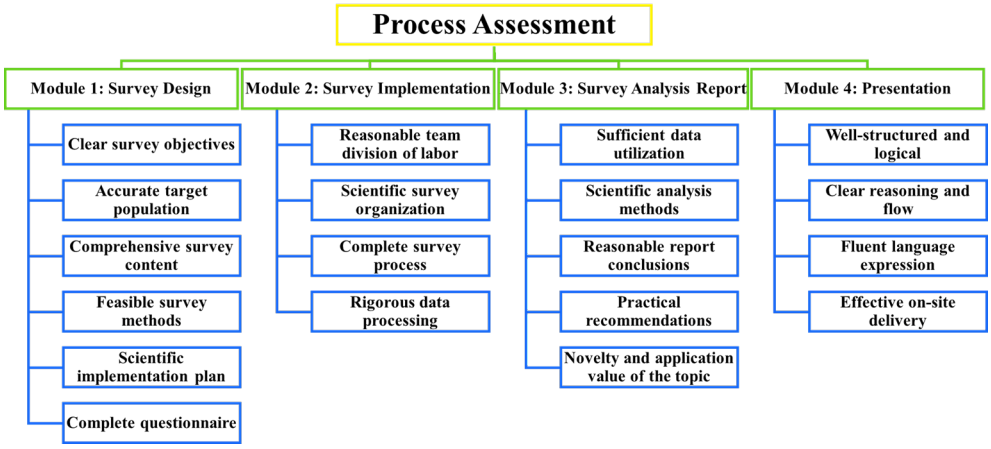

Figure 2. Formative Assessment Evaluation System for the Statistics Course.

4.2. Enhanced Autonomous Learning Capacity and Classroom Interactivity

The BOPPPS-based blended teaching mode enables students to schedule preview tasks efficiently, while Learning Management System functionalities — including group tasks, interactive modules, and incentive mechanisms — coupled with practical platform exercises, significantly improve teacher-student interaction, optimize instructional quality, and enhance oral communication skills. With Learning Management System course activities exceeding 50,000 instances and student participation surpassing 1000 engagements, evidence demonstrates that participatory learning effectively stimulates proactive engagement.

4.3. Optimized Integration of Teacher's Digital Pedagogical Competencies and Ideological-Political Education

Within the BOPPPS-based blended (online-offline) teaching model, the synergistic fusion of educators' digital pedagogical competencies and curriculum-based ideological-political elements constitutes not only a pivotal innovation in instructional design but also an essential pathway to foster virtue through education. By seamlessly embedding ideological-political elements into online resource development and offline classroom interactions for Statistics, this approach elevates demands on instructional design proficiency, driving continuous enhancement of digital teaching literacy and value-oriented educational awareness. Concurrently, it cultivates professional identity among aspiring statisticians and instills evidence-based professionalism — applying data-driven discourse and scientific decision-making.

4.4. Conclusion

The implementation of the BOPPPS-based blended teaching model in the statistics course has proven to be effective in improving both student learning outcomes and engagement. By incorporating a formative assessment system and focusing on practical abilities, the course enhanced students' skills in teamwork, data analysis, and communication. The use of digital tools and the Learning Management System facilitated greater interaction between students and teachers, fostering a more participatory learning environment. Additionally, the integration of ideological-political education within the teaching process not only elevated the quality of instruction but also helped students develop a strong professional identity and a data-driven approach to decision-making. Overall, the blended teaching model has led to a more dynamic, interactive, and value-driven learning experience, benefiting both students and educators.

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