

Research on Constructing a Smart Classroom for Computer General Education Courses Centered on Students

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Abstract:

This study addresses the challenges encountered in the construction of computer general education courses and proposes a solution to build a smart classroom centered on students for these courses. By introducing MOOC resources, flipped classrooms, and SPOC platforms, the full utilization of high-quality online course resources is achieved, promoting the transformation and innovation of classroom teaching models in universities. The construction of the smart classroom encompasses the integrated development of teaching resources throughout the entire learning cycle, including pre-class preview materials, rich in-class teaching resources, and post-class extension materials. Through the implementation of the flipped classroom teaching method, students preview before class, engage in discussions on preview questions during class, and cultivate their autonomous learning abilities and innovative thinking. The research results indicate that the smart classroom significantly improves students' learning engagement and participation, fostering the healthy development of their comprehensive abilities. Additionally, smart teaching enhances students' learning motivation and interest, improves teaching quality and efficiency, and injects new vitality into the development of higher education and the cultivation of innovative talents. This study not only theoretically reveals the essential characteristics and inherent laws of smart teaching but also achieves remarkable results at the practical level, providing strong support and guidance for smart teaching in computer general education courses.

Keywords:

Smart Teaching, Flipped Classroom, Resource Integration

1. Introduction

On the road to becoming a strong country in higher education, higher education generally faces challenges such as high student teacher ratios and heavy teaching tasks for teachers. To improve the quality of teaching, it is necessary to update teaching concepts, use new technologies to transform teaching methods, and solve

problems such as how to fully and effectively utilize high-quality teaching resources. The selection and reorganization of MOOCs [1] resources provide the possibility to fully utilize and share advantageous teaching resources. The flipped classroom teaching method [2] can promote students' autonomous and research-based learning, reflect their subject status in the learning process, and cultivate their learning ability and innovative spirit. The SPOC platform [3] can provide comprehensive support for blended online and offline teaching, monitor the entire process of students' learning behavior, and collect panoramic teaching data to provide a basis for adjusting teaching strategies and issuing quality warnings.

The student-centered teaching philosophy emphasizes that in the process of education and teaching, students are always the main body of education [4,5,6], and all educational activities must be closely centered around students. This concept requires designing teaching based on the individual characteristics of students, adhering to the principle of teaching for all, taking into account differences, and categorizing teaching, so that every student can make progress and development on the basis of their existing knowledge. Therefore, researching student-centered smart teaching is of great significance in addressing the pain points and issues in current higher education, and can help improve the level and quality of education and teaching.

By constructing a student-centered smart classroom[7,8], we aim to enhance students' learning engagement and participation, cultivate their learning abilities and innovative spirit. At the same time, by combining MOOCs, flipped classrooms, and SPOC, we can fully utilize high-quality online course resources, promote the transformation and innovation of classroom teaching models in universities, and further promote the healthy development of students' comprehensive abilities. Therefore, this study not only has important theoretical value, but also has broad practical application prospects.

2. Integration and Construction of Three-dimensional Full Cycle Teaching Resources

The three-dimensional full cycle teaching resources cover the teaching content before, during, and after class, forming a complete teaching system. Provide preview materials before class, such as course introduction, teaching outline, preview courseware, etc., to help students understand the course background and learning objectives, and prepare for classroom learning; Rich teaching courseware, case analysis, experimental projects and other resources are provided in class to support teachers' classroom teaching and students' research-based learning; After class, resources such as expansion materials, review questions, assignments, and exams are provided for students to consolidate their knowledge, expand their abilities, and conduct self-assessment.

Develop new teaching resources based on frontline teaching data and research needs. For example, in computer general education courses, specialized instructional videos, case studies, or experimental projects are created based on the difficulties and key issues identified in actual teaching to fill the gaps in existing resources and better meet the practical needs of teaching.

Optimize existing resources to better adapt to student-centered smart teaching models. Add interactive elements to resources, such as setting up questions and discussion links in courseware, to encourage students to actively participate; Design

interactive classroom themes to guide students to engage in in-depth discussions and collaborative learning during class; Assign independent learning tasks outside of class, clarify students' learning directions and requirements after class, and improve the effectiveness of students' independent learning.

In a mobile learning environment, consider the need for fragmented learning. The design of course resources emphasize the characteristics of fragmented learning, small capacity, and short time. Break down the teaching content into small knowledge points or learning modules, making it easier for students to use fragmented time for learning, such as during breaks, transportation, or other leisure time to learn anytime, anywhere. Each learning segment has relative independence, and students can choose to learn according to their own time and needs, while maintaining an inherent connection with the overall course content.

Establish a mechanism for continuous improvement of resources, and continuously update and improve teaching resources based on feedback from teaching practice and technological development. Regularly evaluate the effectiveness and practicality of resources, revise or replace outdated or ineffective resources, ensure that teaching resources always maintain high quality and applicability, and provide students with high-quality learning materials.

3. Smart Teaching Mode And Data-driven Teaching

3.1. Architecture and Implementation of MFS mode

The MFS smart teaching model combines MOOCS resources, flipped classroom methods, and small-scale restricted online course platforms (SPOCs). Before class, students engage in self-directed learning on the SPOC platform and utilize MOOC resources to enrich their learning content; During class, research-based learning and discussions are conducted between students and between students and teachers, with teachers guiding and mediating the discussion process to promote the internalization of students' knowledge; After class, students engage in extended learning or discussions on the SPOC platform to further deepen their understanding and application of knowledge [9,10]. This architecture achieves a deep integration of online and offline learning, making learning ubiquitous. The architecture of the student-centered smart teaching model is shown in Figure 1.

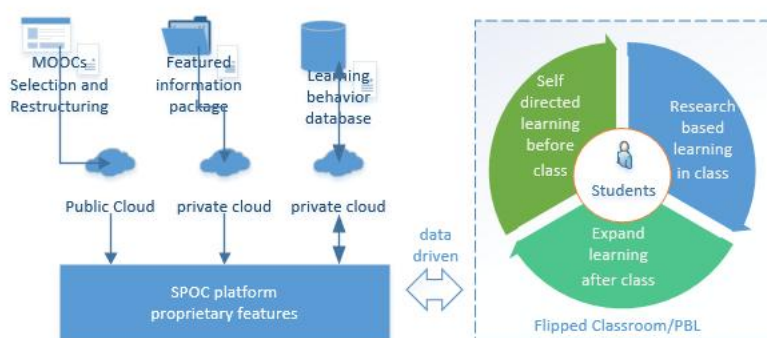


Figure 1. Smart teaching model architecture centered on students.

Resource Introduction and Restructuring: Introducing MOOC resources, teachers select and restructure them based on course teaching objectives and students' actual situations to ensure the pertinence and effectiveness of teaching content. For example,

in computer general education courses, select course content suitable for the students' level from numerous programming MOOCs and integrate it according to the teaching syllabus.

Implementation of flipped classroom: Adopting the flipped classroom teaching method, teachers assign preview tasks before class, and students preview and record questions by watching MOOC videos, reading materials, and other methods [11]; In class, the teacher organizes students to discuss preview questions, guides them to deeply understand knowledge, and cultivates their self-learning ability and innovative thinking.

SPOC platform application: Using the SPOC platform to carry out teaching activities, teachers publish teaching resources, assign homework, and organize tests on the platform, while students learn, submit homework, and participate in discussions on the platform [12]. The SPOC platform records students' learning behavior data, providing a basis for analyzing learning situations and adjusting teaching strategies.

3.2. Data-driven logic in the teaching stage

3.2.1. Self study data-driven logic before class

Data collection: When students engage in pre class self-directed learning on the SPOC platform, the platform records their learning behavior data, such as video viewing page count, viewing duration, preview courseware browsing, and completion of basic knowledge memory exercises.

Data analysis and strategy adjustment: Teachers analyze this data to understand students' mastery of basic knowledge, learning interests, and potential problems, predict difficulties that students may encounter in class, and adjust teaching strategies accordingly. For example, if it is found that most students have difficulty understanding a certain knowledge point, teachers can add relevant case studies or organize group discussions in class.

3.2.2. In class research and interactive data-driven logic

Data collection: During class, the platform collects interactive data on student participation in discussions, including barrage interaction content, submission and questioning situations, in class test scores, and student participation in collaborative learning.

Real time feedback and guidance: Teachers use this data to understand students' learning status and knowledge mastery in real time, guide students' discussions, answer students' questions in a timely manner, and provide concentrated explanations for common problems among students to ensure the effectiveness of the teaching process. For example, by analyzing barrage interaction data, if it is found that students have a deviation in understanding a certain concept, teachers can immediately correct and supplement the explanation.

3.2.3. Expand and enhance data-driven logic after class

Data collection: After class, the platform records students' data during the extended learning stage, such as homework detection results, participation in discussion and interaction, completion of practical training, etc.

Evaluation and improvement: Teachers evaluate students' learning outcomes by analyzing these data, determine whether students have achieved expected learning goals, and understand their ability levels in knowledge application and expansion. Based on the evaluation results, provide personalized learning suggestions for students, while improving teaching content and methods to provide reference for subsequent teaching.

4. Empirical Research and Analysis

Select three classes as experimental classes in the Computer Fundamentals and Programming course to implement smart teaching. These three classes comprehensively apply the smart teaching mode in the teaching process, covering various teaching links before, during, and after class, to compare with traditional teaching classes and verify the effectiveness of smart teaching. During the teaching cycle, the three experimental classes had a high level of student participation and overall attendance (100% in Classroom 1, 92% in Classroom 2, and 98% in Classroom 3, totaling 97%), indicating that students have a certain level of acceptance and enthusiasm for the smart teaching model. Students actively participate in various teaching activities during and after class, with a total of 20846 interactions between teachers and students, 32 posts in post class discussions, and 448 cumulative replies, reflecting their level of activity in a smart teaching environment. Each part of the smart teaching activity consists of both teacher activities and student activities. Students preview and provide feedback on their preview before class. In the process of classroom research and learning, there is a three-dimensional interaction between teachers and students, as well as between students themselves. In the after-school stage, students communicate and discuss, expand their learning content, and teachers provide personalized tutoring based on students' differences.

4.1. Validity verification of the full cycle data package of smart teaching and MFS mode

The effectiveness of the full cycle data package: The smart teaching full cycle data includes rich teaching resources before, during, and after class, and its systematic, complete, interactive, lightweight and other characteristics have been verified in practice. Students can engage in self-directed learning, previewing, reviewing, and expanding their learning based on the resource package. The various forms of resources in the resource package (such as courseware, videos, graphic materials, practice questions, etc.) meet the diverse learning needs of students and help improve learning outcomes.

The effectiveness of MFS teaching mode: The MFS teaching mode (combining MOOC resources, flipped classroom, and SPOC platform) has demonstrated good results in practice. MOOC resources provide rich materials for teaching, flipped classroom stimulates students' interest and initiative in learning, and SPOC platform realizes personalized learning support and full process learning monitoring. For example, students use MOOC resources for pre class preparation, actively participate in discussions and explorations in flipped classrooms, and the SPOC platform records learning behavior data and provides a basis for adjusting teaching strategies. The three work together effectively to promote students' learning and ability development. Meanwhile, the collection and analysis of practical data based on this teaching model have further demonstrated its effectiveness in improving teaching quality and student learning outcomes.

4.2. The improvement of students' learning engagement and participation

Improvement in learning engagement: According to data statistics, students' engagement in self-directed learning before class has significantly increased. For example, the total number of courseware released in three classes reached 69, with a total of 819 pages, 303 inserted exercises, 106 videos, and a total of 19.78 hours of online video class hours. These data indicate that students actively participate in pre class preparation, actively acquire knowledge, complete basic knowledge memory and primary understanding tasks, and their learning enthusiasm and initiative are stimulated.

Significant increase in participation: Student engagement during and after class has also significantly increased. The total number of interactions between teachers and students in class was 20846, with 56 live broadcasts opened, a total live broadcast duration of 14.04 hours, and a total of 2509 participants; The total number of post discussions after class is 32, with a total of 448 replies. Students showed active participation in activities such as submission and questioning, barrage interaction, and discussion interaction, actively engaging in classroom exploration and expanding learning after class. This indicates that the smart teaching model effectively promotes students' willingness to participate in the classroom and their enthusiasm for interaction.

5. Conclusions

This study explores in depth the practical path and effectiveness of constructing a student-centered smart classroom for computer general education courses. Through interdisciplinary integration perspectives and deep integration of theory and practice research methods, we have revealed the essential characteristics and inherent laws of smart teaching, and constructed a long-term effectiveness evaluation system that includes multiple dimensions such as academic performance, learning satisfaction, learning motivation, and learning ability.

The research results show that smart classrooms can significantly improve students' learning engagement and participation, and promote the healthy development of their comprehensive abilities. By implementing a blended learning model that combines MOOCs, flipped classrooms, and SPOC, we have fully utilized high-quality online course resources and promoted the transformation and innovation of classroom teaching models in universities. In addition, we have designed a diversified performance evaluation scale to comprehensively and objectively evaluate students' learning outcomes.

The application of smart teaching not only enhances students' learning motivation and interest, but also improves the quality and efficiency of teaching, injecting new vitality into the development of higher education and the cultivation of innovative talents. By optimizing teaching resources and activity design, innovating teaching activity forms, and implementing personalized teaching recommendations, we have further enriched the connotation and practical path of smart teaching.

In the future, we will continue to deepen our understanding and practice of the concept of smart teaching, explore more innovative teaching strategies and methods, in order to promote the comprehensive development of students and the sustained progress of higher education.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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