



Research and Design of SPOC Teaching Service Platform Based on Big Data Technology and AHP

Jiajing Cai¹, Huandong Chen²(✉), Jinmei Shi¹, and Guangfu Zhang¹

¹ School of Information Engineering, Hainan Vocational University of Science and Technology, Haikou, China

² School of Information Science and Technology, Hainan Normal University, Haikou, China
caijj_claire@163.com

Abstract. Higher education has been transformed and reformatted as a result of the new generation of information technology, which is typified by mobile Internet, artificial intelligence, and big data. Higher education will inevitably undergo a digital transition as it moves from the traditional period to the digital era and even the coming exponential era. Given the current issues with online teaching platforms in higher education institutions, this paper conducts research and designs a teaching platform based on SPOC in an effort to enhance and improve the teaching service system of higher education institutions. This study developed a teaching service platform with three main characteristics to address the primary issues of inadequate personalisation, subpar real-time supervision, and subpar thinking growth. It also implemented teaching evaluation based on Hadoop computing architecture and AHP approach. It aids in the development of a teaching service platform that has a perfect structure, a thorough procedure, and a high level of generalization.

Keywords: SPOC Teaching Service Platform design · Personalization Teaching · Teaching Evaluation Method

1 Introduction

With the rapid development of information technology, universities have improved their system construction employing information technology, and in the context of intelligent education, teaching management is gradually becoming scientific, professional and intelligent, and it can realize the intelligent education integrated service mode of “resource - data - service” which improved the quality of education and teaching in colleges and universities [1].

Under the influence of “Internet +”, the online teaching and learning management system of MOOC and SPOC has emerged [3]. SPOC is an online education system based on MOOC, and the emergence of SPOC has made it possible to open the MOOC platform for a small group of university students. However, in fact, because most SPOCs are still running with MOOCs with profit objectives, the interface of student learning management has not changed much and still remains at the preliminary management

level [4]. For example, many online learning platform for college students still has limitations in respecting students' personalized development, and the participation rate of SPOC online classrooms is not high [2]. Therefore, the current SPOC platform still needs to be improved in terms of advancement and intelligence.

In this paper, a SPOC teaching service platform is designed to solve the problems in the existing SPOC system. It breaks through the bottleneck of the current MOOC and SPOC platform online education by optimizing the learning management interface for students, focusing on serving students, achieving convenience, comfort and reasonableness in human-computer interaction, fully exploiting student behavior data, and developing online and offline teaching according to students' individual characteristics, improve the students' interest in learning and the purpose of personalized and in-depth teaching.

2 Design Ideology of the Platform

The previous SPOC platform was operated by MOOCs [6], so there were some problems in the system design, such as lack of personalization, stratification and difficult access to data, which could not support diversified teaching activities and students' personalized independent learning [7, 8]. Therefore, the overall design concept of SPOC teaching service platform designed in this paper includes: 1) Integrating the personalized learning concept into the design, so that teachers can better adjust the teaching design according to the teaching practice. 2) Helping students establish a knowledge structure in line with the law of talent development and progressive skills practice platform and assisting students to develop self-learning habits and awareness. 3) Having intelligent data processing ability, which is convenient for teachers to view real-time learning data, which is conducive to timely adjustment of teaching programs.

3 The Framework of Teaching Service Platform Based on SPOC

Teachers should explore the excellent value related to knowledge content, so that teaching design is not limited to mastering knowledge, but also to improve the intelligent level of understanding, transformation and transfer ability, and promote the all-round development of students [10]. Therefore, the module created by the SPOC teaching platform consists of four modules, as shown in Fig. 1, which are the basic course information module, curriculum knowledge system module, curriculum basic teaching resources module and curriculum extension teaching resources module. Each module contains a specific branch structure, which systematically supports the teaching team to build an innovative, intelligent and personalized teaching service platform.

3.1 The Basic Course Information Module

The basic course information module was divided into three main functions: selecting the team, selecting the course under construction and creating the course. When setting up and creating courses, various and detailed functions of the system can be used to

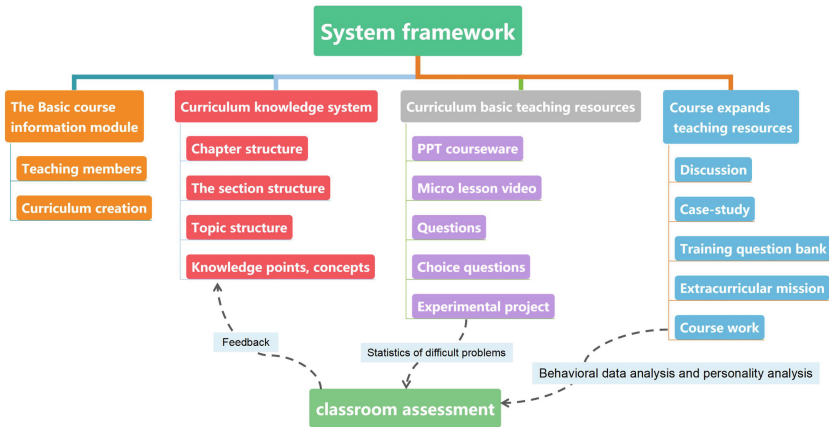


Fig. 1. The framework diagram of SPOC teaching service platform.

achieve diversified course custom settings. It could help students quickly understand the basic information of the course in the system, and help select the right teaching team, and provide various types of teaching resources uploaded to meet the different teaching goals of the teaching team and other system functions.

3.2 The Course Knowledge System Module

The course knowledge system supported by this system includes four-level directory, namely chapter, section, topic and knowledge point and three-level directory (chapter, topic and knowledge point) structure, as shown in Fig. 1. The teaching service platform proposed in this paper sets the first-level structure and second-level structure of the knowledge system into chapter structure and section structure. After creating and editing the setting of a certain chapter and section, the designer and organizer can further set the theme structure in the system setting, and upload the teaching theme content files at the same time, so as to achieve the construction of a complete course electronic resources. In the system, knowledge point is the basis of knowledge module. Through flexible and diversified knowledge point function design, it assists the teaching team to achieve the teaching objectives of knowledge imparting, ability cultivation and personalized shaping. It also provides the function of creating and editing course knowledge points and setting the weight of knowledge points for realize the distinction between the important content of teaching, which guides students to apply learning time and energy to effective level and provides a more comprehensive and flexible intelligent teaching service.

3.3 Teaching Resource Management Module

Training students to apply knowledge to skills and to solve practical problems is one of the key issues in the reform of higher education. Therefore, the SPOC Teaching Service system has designed an expanded teaching resource module to facilitate the implementation of a variety of teaching activities, as displayed in Fig. 1. In the teaching

resources management module, the system sets a special function module of discussion questions, which can test students' understanding of knowledge points, and exercise their analytical ability and the construction of logical thinking. Teachers can add and edit discussion questions for a chapter in the SPOC teaching service platform. In addition, the system can also design specific practical operation cases and training question banks for a certain knowledge topic in the course. Practical operation cases can help students have a reference to the steps before doing the problem, help students to cultivate self-learning ability. The training question bank can scientifically reflect students' ability to master basic knowledge and apply knowledge.

3.4 Teaching Evaluation Module

Teaching evaluation is an activity to judge the value of teaching process and results according to teaching objectives and serve for teaching decision-making. It is a process to judge the actual or potential value of teaching activities and also a process to study the value of teachers' teaching and students' learning [1]. The teaching service platform designed in this paper proposes a teaching evaluation algorithm based on the AHP (Analytic Hierarchy Process) method and Hadoop computing architecture of big data technology, so as to improve the existing teaching mode and improve the teaching quality. Because the courses created on the SPOC teaching service platform are affected by a variety of teaching quality evaluation indicators, each of which has a different weight in the teaching evaluation, it is difficult to quantify the teaching effect through a simple mathematical operation.

First, the evaluation matrix is constructed, and the matrix E is expressed as the Eq. (1).

$$E = (e_{ij})_{n \times n} \quad (1)$$

where, n is the number of rows and columns in the horizontal and vertical directions of the matrix determined by the secondary indicators, and e_{ij} is the degree coefficient, generally set as [1, 10].

When different types of courses are evaluated, they focus on different criteria, so it is necessary to standardize the indicators. Therefore, in order to solve the homogeneity problem of different index values, it is necessary to convert the absolute evaluation value into relative value, and then adopt normalization treatment followed as the Eq. (2).

$$e'_{ij} = \frac{e_{ij}}{\sqrt{\sum_{i=1}^n e_{ij}^2}} \quad (2)$$

The elements in the normalized matrix E' are added in rows to obtain vector e, and then the vector w is normalized to get the maximum eigenvector e^T . The maximum characteristic root R_{max} could be obtained by the Eq. (3).

$$R_{max} = \frac{1}{n} \sum_{i=1}^n \frac{E \cdot e^T}{e_{ij}} \quad (3)$$

Besides, the consistency test is used to judge the consistency of the largest feature roots. Firstly, the consistency index CI was calculated according to the Eq. (4), and then the

obtained CI value was put into the Eq. (5) to calculate the random consistency ratio CR. Where, RI is the average random consistency index.

$$CI = \frac{R_{max} - n}{n - 1} \quad (4)$$

$$CR = \frac{CI}{RI} \quad (5)$$

When the value of CR is less than 0.1, it means that the maximum eigenvector e^T can be regarded as the weight vector. By multiplying the weight of the second-level index by the eigenvalue, and then summing all the products, the evaluation value of the course can be obtained. The calculation process is repeated to obtain all first-level index scores for the course. The platform designed in this paper uses the above teaching quality evaluation algorithm to evaluate the teaching quality of the course, and outputs the corresponding evaluation results and visual charts in the platform interface.

4 Conclusion

The research on teaching service platforms based on the SPOC teaching platform has profoundly changed the teaching and learning methods as well as the inherent teacher-student relationship, broken the bottleneck of traditional education resources, various types of resources have emerged continuously, and all kinds of scattered resources have been effectively gathered to the same platform, which makes various data silo dilemmas broken. The establishment of a university teaching service system not only enhances the level of teachers and teaching but also becomes a core force to promote the quality of university teaching, excellence, and innovation in higher education.

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