Research on the Construction of Smart Educational Administration System in Colleges and Universities Empowered by Artificial Intelligence Technology

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Abstract: Artificial intelligence (AI) technology promotes the reform of teaching and gives new momentum to the development of smart educational administration system (SEAS) in colleges and universities. In order to explore the direction and approach of the construction of SEAS, this paper adopts the methods of literature research, survey and interview, development and design to conduct theoretical research and practical exploration of the construction of SEAS: It proposes a three-step construction path of environment construction, mode reform and regulation establishment, and creates a design scheme of SEAS for intelligent education, and uses AI technology for development and application. This paper has certain theoretical significance and practical value for promoting the healthy and steady development of SEAS.

Keywords: Artificial Intelligence; Intelligent education; Intelligent campus; Smart educational administration system;

1 Introduction

In recent years, AI technology has been widely used in the fields of e-commerce, manufacturing, public services and so on, bringing new impetus to education informatization. In order to promote the development and implementation of intelligent education, the General Office of the Ministry of Education selected and created 18 intelligent education demonstration zones nationwide in 2019 and 2020 [1][2]. However, in the construction practice, a series of problems such as insufficient system integration, poor data sharing, poor service experience, repeated construction of facilities have been exposed [3]. The university educational administration system EAS) is the core part of the construction of intelligent campus and the core and engine of carrying out intelligent education. This paper will start from the practice of intelligent campus construction, focus on the construction of SEAS in colleges and universities, in order to provide suggestions for the sustainable development of intelligent education and intelligent campus.

2 Analysis of core concepts

2.1 Artificial Intelligence

According to the development track of AI, it has successively gone through symbolic system-robot technology-neural network. Through machine learning, its perception and decision-making ability have been continuously strengthened. AI technology includes: machine learning technology, knowledge map technology, natural language processing technology, human-computer interaction technology, computer vision technology, biometric identification technology, VR/AR technology, etc. With the development of cloud computing and cloud storage, AI technology continues to mature and is widely used in e-commerce, medical treatment, military affairs, public services and other fields, giving birth to terms such as "intelligent earth", "intelligent city" and" intelligent education". After AI technology is involved in education, it is bound to change the teaching relationship, reorganize the technical elements, and trigger the deep education reform.

2.2 Intelligent Education

Intelligent education is a brand new education with five elements of reform: education concept, education environment, teaching resources, teaching model and education governance. The vision of intelligent education is to establish an open learning environment facing the community, the city, the society and the Internet, so that the human social education system will develop into a new educational ecology featuring lifelong learning and open education. [3]

2.3 Intelligent Campus

Intelligent education is a brand new education, with the fundamental goal of promoting the all-round development of students. Intelligent campus is the main carrier to realize intelligent education, and is the main position of education reform in our country now, including intelligent teaching, intelligent management and intelligent life.

2.4 Smart educational administration system

The broad educational administration system includes the educational administration software system as well as the corresponding organizational structure and educational system. EAS is the hub of teaching information and teaching management in colleges and universities. The application of EAS not only reflects the school's teaching concept, teaching model, teaching evaluation, teaching resource management, but also reflects the operation mechanism and process of school management.

SEAS is to meet the needs of intelligent education and talent training in contemporary colleges and universities with the support of the AI technology. At present, the information construction of most universities is in the stage of service-oriented data governance [4], which is characterized by smart. "Smart" is the premise of "Intelligence", and Intelligence is the advanced form of smart development.

3 Contents and ways of constructing SEAS

3.1 Construction contents of SEAS

SEAS construction includes five aspects: education concept transformation, teaching space reengineering, teaching form change, teaching resources reconstruction, and education governance system precision.

1) Educational Philosophy

The concept of intelligent education is [5] :the mission of education is to promote the educated to form the wisdom of truth, goodness and beauty, so that they continue to move toward free and comprehensive development; educational content includes three types of wisdom: seeking truth, seeking goodness and seeking beauty; educational methods, knowledge is the basis of wisdom, intelligent education is the process of turning knowledge into wisdom, the following four tasks need to be completed to achieve this goal: First, construct a system of educational objectives aimed at pursuing the cultivation of wisdom. Second, to build a intelligent curriculum system. Third, to build a intelligent life practice system. Fourth, to build a intelligent teacher team.

2) Teaching Space

Intelligent teaching space includes both hard space and soft space. The so-called hard space is the physical space that supports teaching such as intelligent classrooms and intelligent labs. The so-called soft space is the learning resources and teacher tutoring system that support independent learning. Higher education is mainly to support students' independent learning, convenient access to teaching resources is the premise, and providing timely self-learning support is the key. The support can be combined online and offline, offline can be face-to-face for Q&A, online can collect difficult topics for point-to-point Q&A within a certain period.

3) Educational form

Educational form includes teaching mode and learning mode, specifically including school management mode, teaching organization mode, learning organization mode, service-learning mode, etc. The intelligent campus presents a unique educational form, and its biggest feature is openness, which is manifested in three aspects: school form openness, teachers openness and credits openness [6]. The main features of intelligent learning include [7]: the learning goal changes from "knowledge" to "wisdom", the learning environment has been expanded from classroom to borderless learning, the form of learning has been changed from "cooperation of all" to "human-machine-human integration", the content of learning has been changed from "uniform lecture course" to school-based independent inquiry and practical course, and the learning assessment changes from "result judgment" to "thinking development".

4) Educational Resources

The development of educational resources in higher education focuses on three areas: professional curriculum restructuring, school-based curriculum development and interdisciplinary curriculum integration. The reconstruction of professional courses requires repositioning the traditional training objectives, sorting out the competence index system and

establishing a new curriculum system oriented by competence. The implementation team should be composed of teachers who are capable, willing and share the same educational concept, and need active guidance and help from the school.[8] The content of the curriculum should be differentiated, with central and local, key and general, public and private institutions offering courses according to their own development levels and characteristics, based on the strengths of our disciplines, and teaching practices aimed at serving the location of students.[9] The realization of interdisciplinarity is a systematic process that requires changes in the teacher training system, recognition of the educational philosophy of school leaders, and the enhancement of interdisciplinary literacy of in-service teachers to support it.[10]

5) Educational Governance

The main bodies of higher education governance will be diversified, among which the government and colleges and universities are the main governance parties, and families and enterprises are the auxiliary governance parties, so as to build the internal and external linkage mechanism of colleges and universities and give full play to the governance smart of multiple subjects. [11] The core of higher education governance is to enhance the autonomy and creativity of people, and autonomy is the basis of creativity. The key to higher education governance is to effectively allocate various educational resources to achieve educational equity [12].

3.2 Construction ways of SEAS

The construction of SEAS is a system project, which is the result of the synergistic development of education reform and education informatization and needs to be carried out in a comprehensive planning and orderly manner. Based on the current situation of education development, the main body of construction is government-led and multi-party collaboration, education change is a matter of national planning and people's livelihood, the government controls the main direction, while actively mobilizing the enthusiasm of universities and absorbing the power of enterprises for collaborative development [13]. The whole intelligent process will start from the environment and depends on the regulation, specifically, that is, three steps: environment construction, strategy and model innovation change, and regulation establishment. Three principles of environment construction: user-centered, data-centered, service-centered, the construction process should break through the limitations and system considerations. So far, the use of AI technology to create a intelligent teaching environment has become the first task of SEAS construction.

4 Design of SEAS In Universities

4.1 Demand analysis of SEAS in universities

1) Demands of teaching management

The university EAS is a complicated business. According to the analysis of students' completion of academic process, the business includes nine items as shown Table 1.

Table 1 Teaching management business requirements

Business Name	Business Requirements
Academic Registration	Enrollment, re-enrollment, suspension, withdrawal, graduation
Faculty Management	Course allocation, teaching supervision, performance management
Course Management	Scheduling, class selection, class withdrawal, course substitution
Performance Management	Grade entry, change and replacement, learning points
Professional Management	Creation of majors, maintenance and updating of training programs
Academic Alert	Grouping warning, delayed graduation warning
Student Analysis	Learning behavior analysis, performance analysis and prediction
Course Analysis	Achievement analysis, teaching quality assessment, impact factor analysis
Professional Analysis	Analysis of grades and evaluation of academic style

2) Teaching needs of teachers and students

Students' needs: intelligent course management and independent learning support. Intelligent course management means that the EAS can recommend course selection plan, credit accounting, and course warning according to students' identity, so as to give students course management support and improve user experience; the so-called independent learning support refers to providing students with time, space, learning resources, and course guidance for independent learning.

Teachers' needs: teaching resources acquisition, creation and sharing platform; student learning record, statistics, analysis, prediction, process evaluation, etc.; research management such as project management, funding management, etc.

3) Off-campus user requirements

External teachers: access to teaching resources, course teaching, grade management; parents of students: access to student information such as school registration information, course information, grade information, etc.; teaching resources unified unit or enterprise: construction, sharing and access to teaching resources.

To sum up, the SEAS has diversified users and is semi-closed. Internally, it mainly supports students' independent learning and school management business; Externally, it supports teachers, entrepreneurs and engineers outside the school to participate in course teaching and resource construction.

4.2 Structure of SEAS

As the core part of the intelligent campus construction, the SEAS has its database, server, and firewall deployed in the private network on campus to ensure data security, and outside the firewall, instant access can be realized through mobile network, WIFI, wired network, smart phones, PC, IPAD and other terminals. Users include teachers, students, and other personnel with different roles and different access rights, and resource access is not restricted by physical space, as shown in Figure 1.
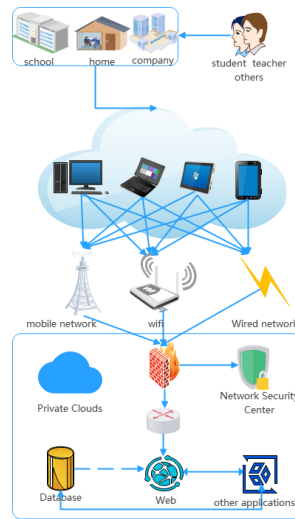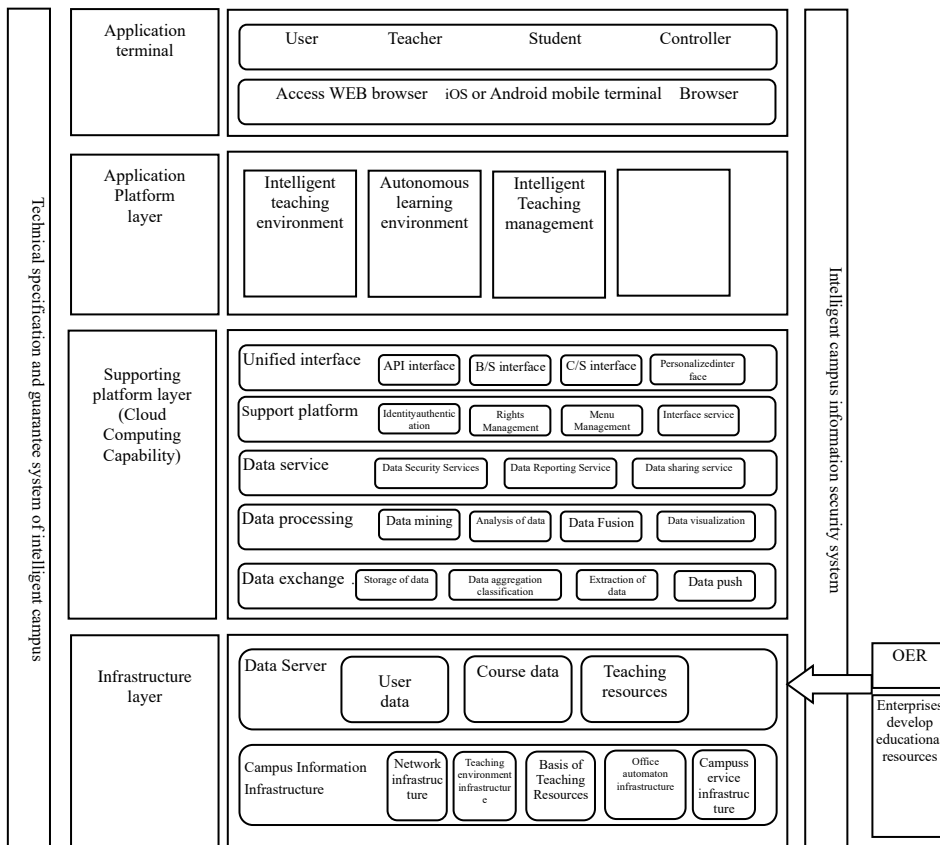
Fig. 1 SEAS Deployment

Fig. 2 System architecture of SEAS

As a part of the intelligent campus, the SEAS is embedded in the architecture system of the intelligent campus [14] for implementation. The overall is divided into four layers: infrastructure layer, support platform layer, application platform layer, and application terminal (Figure 2).

4.3 Functional Module Design Of SEAS

The SEAS in higher education mainly includes four functional modules of intelligent teaching, intelligent management, independent learning and teaching resources, as shown in Figure 3
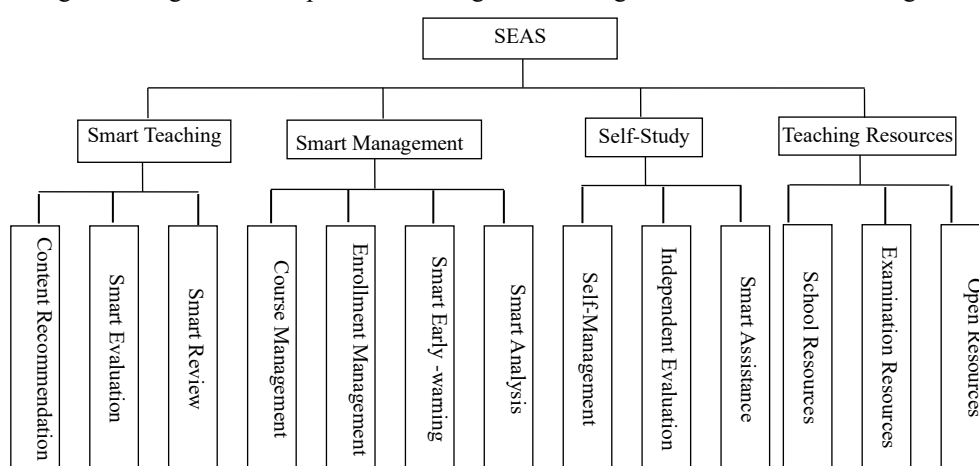

Fig. 3 Function module diagram

Smart Teaching Module contains three sub-modules: content recommendation, smart assessment, and smart learning assessment. Content recommendation means that teachers and students can get learning resources conveniently in the classroom or outside the classroom, teachers get teaching resources including teaching contents, teaching design, electronic tools, etc. according to teaching objectives, and students get adaptive learning contents according to their learning situation; smart assessment means that teachers can adopt online assessment at any time during the teaching process, and students can give feedback on their learning situation by answering questions online, and teachers can understand students' smart learning assessment means that the teacher can record students' performance through online video equipment, and then analyze students' behaviors such as classroom discipline, number of times they raise their hands to answer questions, whether they play with cell phones, communication status, etc. through artificial smart analysis technology to form a complete process evaluation of students' knowledge mastery, attitude, cooperation awareness, classroom discipline, etc. The dynamic cycle of the three sub-modules forms a smart teaching chain.

Smart management module contains four modules of course management, student registration management, smart warning and smart analysis. Course management includes four sub-modules: teacher scheduling, student course selection, examination arrangement, and grade management. The system uses recommendation algorithms to smartly account for the subjects to be selected by students (limited and retake) against the training plan and transcripts, and recommends the course selection list for students to prevent students from making

mistakes and omissions, and to improve the operating experience of course selection; academic registration management includes five types of enrollment, suspension, withdrawal, reinstatement and graduation, and all applications and approvals are completed online. All applications and approvals are done online, and course substitutions and grade audits occurring due to academic registration conversion are smartly audited by the system according to the training plan, students' grades and academic registration types, and a list of audit results is generated for students to check and sign, which improves work efficiency and reduces the burden for management teachers. In the course of teaching, students' class test scores and attendance are recorded in the system, and the system adopts supervised learning algorithm to model students' performance in previous years as training set and make prediction for students in this semester. At the end of the academic year, the system calculates the students' compulsory, limited and optional courses in accordance with the training plan and the students' grade list, and issues a coding warning to the students whose science scores exceed the standard line; in the senior year, the system calculates the compulsory, limited, optional, independent credits, physical fitness test and social practice in accordance with the graduation conditions, and issues a delayed graduation warning to the students who do not meet the conditions; the intelligent analysis is realized in a visual way, including student source analysis, grade analysis, course analysis and major analysis. Student source analysis mainly analyzes student group information such as male to female ratio, origin, ethnicity, age distribution, etc. to understand the basic situation of students. Grade analysis includes four levels of analysis: individual students, classes, majors, and grades. Students can view their grades and fluctuations in each semester, compare horizontally between classes, and compare vertically between majors and grades, providing a basis for counselors and leaders to evaluate classes and majors. Course analysis allows horizontal and vertical comparison of each teaching class and analysis of teaching influencing factors.

Self-learning module contains self-management, self-assessment and smart assistance, this module is the auxiliary part of smart teaching module, and its realization requires schools to set up corresponding auxiliary teaching positions and auxiliary systems in addition to computer system functions. Independent management includes learning objectives, learning contents, learning methods, and learning time management, where students can view teaching objectives, teaching contents, and learning methods provided by the auxiliary teachers. The whole learning process is timed smartly by the system, and smart reminders are given when the content is not completed. Self-assessment is the assessment part after students finish independent study. The system draws questions from the test bank according to the knowledge points, and students need to complete the paper within the specified time. For problems that cannot be solved by individuals, students can turn to the smart assistance board, which allows students to post difficult questions on the board and answer each other's questions, and for common problems the teachers of the teaching and support post collect them centrally and give feedback to the teachers in charge of the class or answer questions during offline tutoring time.

Teaching resource library is the core part of intelligent teaching service, contains school-based resources, examination resources and open resources. School-based resources refer to the local courses and interdisciplinary courses developed with the university's specialties, reflecting the concept of discipline integration and theoretical connection with practice, and the types of resources include teaching design, videos, handouts, cases, projects and so on; examination

resources are the test bank developed with the orientation and specialties of the university, and the content and difficulty of the test questions reflect the concept of student evaluation, which should pay more attention to students' literacy and ability while examining the mastery of basic knowledge. The content and difficulty of the test questions reflect the concept of student evaluation. The open resources include two meanings: on the one hand, the open resources of other universities and enterprises will be absorbed to supplement teaching and open up horizons; on the other hand, the public course resources developed by the university will be opened to the public for use by learners outside the university. The whole teaching resource library will form an ecological chain of creation, review, use, evaluation and update.

5 SEAS Development Practice in Higher Education

The project team develops and practices three sub-modules: content recommendation, course management, and intelligent analysis.

5.1 Course selection module based on recommendation algorithm

Smart course selection module system architecture is divided into four layers: data layer, service layer, content layer and customer layer, using B/S mode, Java language development. The users of the system are students, teachers and academic administrators, and teaching and management are taken into account to realize the functions of course selection for fresh students, course replacement and course selection for students with different academic registrations (grading, re-entry, transferring majors), and recommendation of optional courses or examination courses. The system uses content recommendation and collaborative filtering recommendation algorithm, based on students' grade records, personal course selection records, course evaluations, friend and neighbor course selection and other data comprehensive recommendation, to realize course selection list filtering, the course selection interface only shows students' own relevant courses, to realize personalized course selection list recommendation for each user, to improve students' course selection experience and course selection efficiency.

5.2 Study on The Factors Affecting Students' Performance in Advanced Mathematics Based on Regression Algorithm [15]

The experiment was conducted with 2145 students in the class of 2020 in a university in Jiangsu, with higher mathematics performance in the academic year of 2016-2017 as the dependent variable and 19 factors such as gender, place of origin, family economic situation and career planning situation as the independent variables, using stratified regression and stepwise regression methods. Experimental results: 11 factors such as gender, place of origin, family economic situation, and career planning situation have significant effects on students' higher mathematics performance, and psychological assessment level, number of teaching classes, and counselors have no effects on higher mathematics performance.

The experiment concluded that, under the same conditions, Jiangsu female students with financial difficulties in family, clear career plan and non-repeated higher mathematics scores would be higher. To verify the experimental results, the project team prepared an electronic questionnaire to investigate "what are the influencing factors of higher mathematics", and the

results of the questionnaire and the results of the stratified regression were consistent. Through this experiment, the project team made suggestions to the university academic affairs office in three aspects: student management, classroom management, and higher mathematics teaching, to provide support and basis for higher mathematics teaching and management.

5.3 Teaching Data Visualization

Visualize student distribution, individual performance analysis, and comparative class and major performance data.

Use the map to display the distribution of student population. The difference in the number of students is shown in color, the more the number of students the warmer and brighter the color, the less the number the darker and cooler the color, when the mouse points to the corresponding province, the number of students in that province is displayed. (Figure 4)

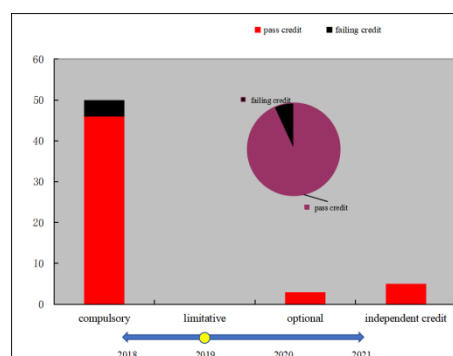**Fig. 4** Distribution of students nationwide

Fig. 5 Academic year credit bar graph

Student's individual performance analysis. As shown in Figure 5, it shows the complete academic score of student A in four academic years, including four items of compulsory, limited, optional and independent credits in the horizontal axis, and the number of credits in the vertical axis, and the lower academic year axis can be dynamically switched or automatically selected for each academic year, and the graph shows the credits earned and credits pending for the selected academic year accordingly. The pie chart on the upper right side of the graph shows the percentage of credits and credits earned, which gives an overview of the academic situation in each academic year.

6 Summary and Outlook

Educational administration system is the hub of university teaching management, it is suggested to concentrate financial resources and manpower priority construction. The construction of smart educational administration system is based on the current situation and demand of colleges and universities. It should be carried out with planning and focus, and should not blindly follow the trend. At present, the construction of smart educational administration system in colleges and universities is in the link of environmental construction, and the chain of data collection, storage, sharing, analysis and visualization is basically formed. The next important task is to create a big data center, break through data islands,

effectively realize data sharing, give play to the effect of data analysis, and enhance the support for students' independent learning.

Project Fund

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