Design of an Interactive Educational Information System Based on the SECI Model

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Abstract. The construction of an educational informatization application system has become an important content of current educational informatization construction. Based on SECI knowledge management model, this paper discusses the training of teachers and the construction of a learning mechanism, and the construction of an interactive teaching platform based on SECI model has become the key to realizing IITC. At present, this kind of education and teaching means and teaching platform is extremely rare, and the construction of information-based colleges and universities has become an inevitable way for the development of schools. Therefore, starting from the reality of our school, it is an urgent problem to build a teaching platform that applies IITC, covers a wide range of teaching contents, supports diversified teaching, and is suitable for interactive classroom teaching mode.

Keywords: SECI model · Interactive education · Informatization · system design

1 Introduction

With the rapid development of computer network technology, human society has entered the information age, and the knowledge economy with high technology as its core will occupy the leading position in the world economy. A country's comprehensive national strength and international competitiveness will increasingly depend on the level of education development, science and technology and knowledge innovation. In the era of knowledge economy, education is required to cultivate innovative spirit and practical ability and comprehensively improve students' comprehensive quality [1]. However, at present, the traditional teacher-centered classroom teaching method is mainly adopted in China's basic education stage, which has become increasingly unsuitable for the requirements of the times for talent cultivation. To promote quality education and cultivate students' innovative thinking, it is necessary to use modern information technology to create a learning-centered autonomous learning environment, so as to improve teachers' teaching methods and students' learning methods [2].

With the rapid development of multimedia and Internet-based communication technology, it is possible to realize a new education mode. As a new type of teaching media,

multimedia and network technology, whose multimedia, flexible and interactive information performance surpasses the sharing of network information resources in time and space, are especially suitable for building an open, interactive and independent information education environment. Countries have taken the application of information technology with network technology as the core in education as an important way to implement the century-oriented educational reform. Its purpose is to realize a brand-new teaching method through the ideal learning environment provided by modern information technology, so as to cultivate a large number of innovative talents needed for the century. Therefore, building an efficient and perfect network education platform for secondary schools based on campus network, providing an ideal environment for teachers' teaching and students' learning, is a subject of great social practical significance, and it is also an urgent task entrusted by the times to our educational technicians [3, 4].

2 The Essential Connotation and Knowledge Construction Field of SECI Model

SECI model, as a typical model of knowledge transformation in knowledge management, includes four models, namely Socialization, Externalization, systematization and Internalization. Socialization is the process of transferring tacit knowledge through communication and experience. Externalization is the process of expressing tacit knowledge into specific explicit knowledge; Systematization is the process of recombining fragmented explicit knowledge into a more systematic explicit knowledge system. Internalization is the process of internalizing explicit knowledge into tacit knowledge through practice. Knowledge transformation needs the support of knowledge field, which corresponds to four modes of knowledge transformation, namely original field, interactive field, system field and practice field. The original field completes the socialization of knowledge and transfers tacit knowledge such as experience and skills; Field interaction realizes the externalization of knowledge, and tacit knowledge is developed into explicit knowledge; The field completes the systematization of knowledge and promotes the generation of innovative knowledge; Practice ranges internalize knowledge, and learners digest their explicit knowledge and turn it into tacit knowledge through practice [5].

2.1 The Original Place and Community Education Environment

The original place in SECI model refers to the initial state of people's life, in which individuals depend on each other and promote each other because of the most authentic contact and communication. The original place, also called the original place, is the starting point of the socialization stage, the source of knowledge creation and the initial state of people's ideological and spiritual activities. As a specific social unit, community organization is the main place for learners, teachers and other social members to communicate together, the joint between theoretical knowledge and social practice, and the important support for the mutual transformation between tacit knowledge and explicit knowledge. Community education is one of the manifestations of community life, and it is an important process for community residents to promote their knowledge transformation from implicit to explicit innovation in the process of receiving education. Usually,

community education focuses on the construction of applied knowledge system, so theoretical knowledge, as tacit knowledge, needs to be transformed into practical ability through students' innovation, which determines that learners can build their own new knowledge system through learning and thinking, discussion and exchange, experience sharing and practice imitation [6, 7]. Community education creates a better learning environment and vision for learners through teaching situation design and curriculum innovation, and promotes the role of the value of community education in social development by constructing an educational framework that can promote cooperative relations, thus promoting the development of national economy and the establishment of a civilized value system in the whole society. The theory of the original place enlightens us that the professional promotion of community education teachers needs to learn together with other members of society to be finally completed.

2.2   Interactive Places and Community Education Mode

SECI model interaction place refers to the organization of groups with special skills and knowledge into task and business groups, and the mutual enlightenment of knowledge and the construction of new knowledge system can be obtained through the interaction among different members [8]. Through the discussion and study of a certain task or problem, each group member discovers the methods and rules to solve problems, thus promoting the improvement of the whole team's learning ability and the optimization of knowledge structure. The application of SECI model interactive place concept in the development of community education can further enlighten the learning autonomy and openness of each group participating in community education. In the Internet age, any kind of learning mode is displayed with a brand-new attitude, and community education is also open to the society by extending the free scale of people's education, providing a personalized education platform for different learning needs. As an important environment for learning and teaching, community interactive platform can not only provide a place for close contact between educational subjects, but also provide opportunities for people to establish lifelong learning concepts and personalized learning programs, and improve the quality of education and the enthusiasm of teachers and students to participate in education from different levels [9]. The application of SECI model in the development of community education under the information condition is the main trend of higher education development, the model of organic combination of real education and virtual education, the main mode of meeting people's learning needs, the important embodiment of promoting teachers and students' initiative and selectivity in teaching interaction, and the important way of revealing tacit knowledge in community education interaction places. The theory of interaction points out that the internal and external communication in community education is an important way to improve teachers' professional level.

2.3   Internalized Places and Community Education System

Under the concept of SECI model, knowledge internalization is an important step to manage knowledge, a link to promote the application, processing and integration of knowledge through a specific occasion, and a process to interactively transform explicit

knowledge with the existing external environment by using various technical means and platforms. On the basis of students' original knowledge structure, the community internalization places continuously input new knowledge systems, so as to construct the connection point between learners' original knowledge systems and new majors, and promote their explicit tacit knowledge. Community education is an important form for community residents who are willing to receive continuing education to acquire a sense of belonging to education, and it is an internalized place to achieve knowledge life through learning [10, 11]. The SECI model concept focuses on the innovation and application of knowledge, that is, people's learning is based on self-growth and serving the society. People need to get growth by interacting with groups in a specific environment, and realize the inheritance and protection of social culture through situational interaction. Community education aims to promote the integration of individuals and groups, and the integration of individual knowledge structure with social development. Therefore, teachers' professional growth, ideological innovation and teaching promotion cannot be separated from the wisdom of the social collective. The connection between SECI model concept and the development of community education reveals that the cultural construction of teachers is the logical node to promote the high unity of their explicit knowledge and tacit knowledge, and the theoretical basis to promote the mutual transformation between knowledge and practice and draw energy from each other [17].

3   Design of Interactive Educational Information System

The interactive management system is developed based on the open source structure of SECI model and using EXTJS technology. The system is mainly composed of management module, homework module, communication module, voting module, BBS module, testing module and resource module. In the aspect of communication, the information exchange between the server and the client is completed by TCP SOCKET programming technology. As far as functional modules are concerned, Web Service is an independent functional unit, which can also be called an independent functional element. Through the directory lookup of Web Service itself, developers can freely change service providers without registering a large number of applications. All data communication and access control are carried out through SOAP protocol. As long as the data information is completely encapsulated into WSDL interface in the design process, these data will be complete, safe, reliable and independent, and any external objects such as Trojans and viruses can't access these data [12]. These attributes determine that this protocol is the only choice for accessing client data encapsulation. In the process of communication, the requirement of large data volume and low access frequency should be strictly followed. By using WADL and basic SOAP request, we can realize that in the actual data output process, the amount of data transmitted at one time is very large, which will inevitably reduce the number and frequency of data transmission. Different from other protocols, SOAP request access can be divided into text mode and remote research mode. The remote call mode is that SOAP can't properly check the text loop in the process of remote transmission, so it's difficult to guarantee the integrity and correctness of data. Therefore, the call in this way does not meet the actual requirements. Text transmission mode requires Web Service to package all data information with SOAP. In practice, the

strict meaning of SOAP is a basic standardized markup language, which requires SOAP to strictly control the type and protocol of data according to the context according to the document type definition protocol in the process of data packaging.

From this point of view, the processing of management module, job module, communication module, voting module, BBS module, testing module and resource module by client server is based on the WEB interactive server. The system has established a module manager (also called module controller) to monitor the database and system clients.

3.1 System Function Design

From the perspective of users, interactive teaching management system mainly includes students, teachers, school leaders and system administrators. In terms of functional use, it will not only be used for daily study of everyday students, but also be used in the field of distance education. In terms of maintainability, it also provides remote system maintenance and management for system administrators. Can also meet the needs of education and teaching. The teaching system platform includes data management module, course management module, teaching content management module and online teaching module. Its main content is to develop and realize the platform of interactive education and teaching system, so as to realize the online real-time interaction between teachers and students [19]. In this topic, a brand-new way-voice instant communication is put forward. This method realizes online teaching between teachers and students. In this way, teachers and students can realize the function of instant interaction on the voice software, and achieve the effect of synchronous communication, simultaneous dialogue and instant reflection [13]. At the same time, during non-teaching hours, teachers can transfer their recorded audio files to the online courseware center system for students to download for self-study and review. According to user categories and system functions, the system can be divided into the following subsystems. The system mainly includes the latest news, test scores, test evaluation, student registration, homework submission, discussion and exchange, teaching handouts, difficult point explanation, online tutoring, past year's examination questions, online training, test analysis, data maintenance, and webpage maintenance. As shown in Fig. 1.
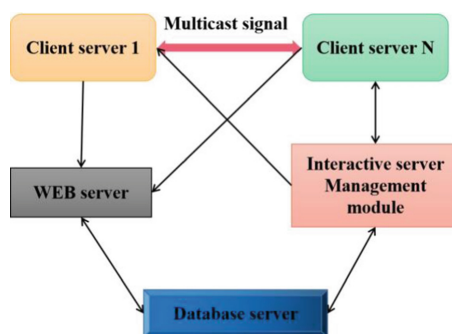

Fig. 1. Client access structure diagram

3.2 System Safety Design

To prevent illegal users from logging in, in addition to the joint security mechanism provided by Windows operating system and My SQL to ensure the security of the system and database server, the system also establishes a system registry for teachers and students, authenticates the logged-in users, and adds the authentication password to the webpage file to monitor the data security [18].

The hardware system of the platform is mainly composed of network firewall and various network devices such as security, authentication, business application, business management and database server. According to different security requirements, the equipment should be set in different areas of the network. Among them, WEB servers, authentication servers, business application servers and intrusion detection servers that cooperate with firewalls to ensure the security above the network layer should be located in DMZ area; Key equipment related to business management, monitoring, database server, etc. are all located in the intranet security area. In different stages of business development, corresponding configurations can be made in the specific implementation according to the different requirements of business scale and security. In the initial stage of business development, when the scale is small, different functions can be realized on the same server (the number of servers in the figure is correspondingly reduced), and the cost can be effectively controlled; When there is a higher demand for security, the platform can also adopt higher-level hardware configurations such as double-layer or multi-layer firewalls, hot standby of switches and adding VPN access servers [14].

3.3 System Database Design

The design and implementation of interactive management system is based on the current situation of teaching management system development. Under the guidance of the basic idea of software engineering, a detailed demand analysis of teaching management system is made. Starting from the functional demand of system design, SECI model development architecture is adopted to complete the system design based on B/S structure. At the same time, combined with various use case diagrams, the system is analyzed in detail. On this basis, the system module design, database design and security design model design are completed. Finally, from the perspective of system implementation and testing, the system features and application effects are demonstrated. In the aspect of functional design, the design and implementation of user management module, homework management module, course scheduling module, student status management module, examination management module, interactive evaluation module and achievement management module are mainly completed [16].

3.4 Information Standard Set

Informatization standard set is a standard that runs through information portal, educational business system and integrated service platform system. It mainly includes four subsets: Informatization Operation Standard Set, Security Monitoring and Operation and

Maintenance Standard Set, Informatization Interface Standard Set and Informatization Data Standard Set.

1. Information operation specification set: the information operation specification set of education belongs to the requirements of mainland business. The set of educational information operation specifications mainly regulates how to use various information systems to handle the affairs within various educational departments.
2. Safety monitoring and operation & maintenance standard specification: Safety monitoring and operation & maintenance standard specification is the relevant specification formulated to ensure the safe and stable operation of the whole system, which includes technical configuration instructions and specific business process instructions.
3. Information interface specification set: the information interface specification set defines the communication mechanism between all different platforms, including the communication mechanism at the application level and the communication mechanism at the data level. All information interface specifications will be implemented by corresponding program modules to ensure the coupling of the whole system at a reasonable level.
4. Information data specification set: Information data specification set is essentially to digitize all kinds of educational business objects, which is the key to ensure the sustainable development of the whole information system. Therefore, the definition process of information data specification set is a very rigorous process, and it needs careful review by all relevant departments.

3.5 Information Operation Management

Information management is the related management work to ensure the normal operation of all application systems based on large platforms. It mainly includes five aspects: data backup management, system backup management, security protection management, patch upgrade management and system monitoring management.

1. Data backup management: all kinds of data in the system are backed up according to a certain backup strategy. The backed-up data includes the databases of each system and the corresponding data files. Backup strategies include disaster recovery, historical data backup, incremental backup, etc.
2. System backup management: make system backup of the servers supporting various application systems, so as to ensure that the system crashes and the middle end of the network caused by various accidents can be recovered quickly.
3. Security protection management: provide security services, including anti-virus, to servers supporting various application systems, so as to avoid the server from crashing due to security problems.
4. Patch upgrade management: provide patch upgrade services to servers supporting various application systems, and realize immediate patch update services for all application systems.
5. System monitoring and management: Monitor and manage the running status of all servers in the system to understand the running performance of each server.

4 Experimental Analysis

The education software architecture based on SECI model is an effective technical means to solve the application problems of education informatization. We have developed five application systems including the education resource platform, the teacher video lesson library, the student video lesson library, the special seminar center system, and the education resource evaluation platform using this architecture, which has successfully helped users solve the cross-platform application problems of education resources and solved the integration of multiple systems of education resources, It improves the use efficiency of educational resources. In order to prove the effectiveness of the design of interactive education information system based on SECI model, a comparative experiment was conducted with the original system to verify the effectiveness of the system. To realize the cross-platform application of educational resources, first of all, it is necessary to realize the unified authentication and unified permission management of users, which is realized by the "unified identity management" of the "education integrated application platform" in the whole architecture. The "education integrated application platform" in the whole architecture can not only provide authentication services for the project, but also provide unified authentication and authorization for all application systems, provide various standardized application interfaces, and ensure the scalability of the system.

In order to realize the cross-platform application of educational resources, the second important link is to realize the cross-platform application data metadata management and realize the unified data of multiple systems. In this project, we need to realize cross-platform metadata management, including the management of teacher information data, student information data, school information data and resource information data. Through the metadata management module of the "Education Integrated Application Platform" in the whole architecture, all information data are managed uniformly and distributed as needed. We have reserved sufficient extension mechanism for metadata management. We can add data fields of various information and expand new metadata schemes according to the needs of system expansion. Through metadata management, the consistency and scalability of cross-system data can be guaranteed technically.

Through the "Education Comprehensive Application Platform", we have realized the cross-platform application business of education resources. Teachers can incorporate educational resources into the "Education Resource Center" through two channels: "video lesson analysis client" and "resource library upload", and then access the corresponding resources according to their needs through different systems such as "education resource library", "teacher video lesson system", "student video lesson system", "thematic discussion system", and "resource evaluation activity" (as shown in Fig. 2).

4.1 Experimental Preparation

In order to ensure the validity of the experimental results, the network settings, equipment parameters and running environment of the two systems are the same. The running configuration of the system is Pentiun (T)dual-SQL CPU, the host memory is 16 GB, and the mining error is 0.01. The specific experimental parameters of the two groups of systems are shown in Table 1.
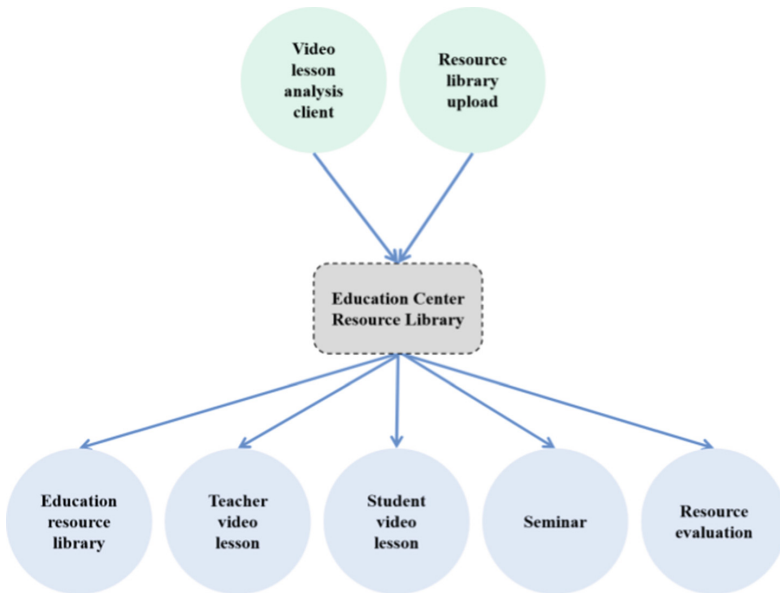
Fig. 2. Cross-platform resource application process

Table 1. Specific experimental parameters of two groups of systems

parameter	set up
Connect to the network	internet
Excavation time/min	2–3
Mining instructions	Cache Instruction
Digging signal	UVMO signal
Mining environment	TE
Excavation quantity/B	7000

4.2 Analysis of Results

In the Fig. 3 shows the experimental results of the two systems in this experiment.

It can be clearly seen from the figure above that after the optimization, the system's achievement for 7 000 students has increased by more than 85%, and the highest achievement has reached ninety-seven percent, while the original system's achievement for 7 000 students has only increased by 87%, and with the increase of the number of students, the achievement shows a downward trend. The experiment proves that the design of an interactive educational information system based on SECI model can effectively improve students' achievement [15].
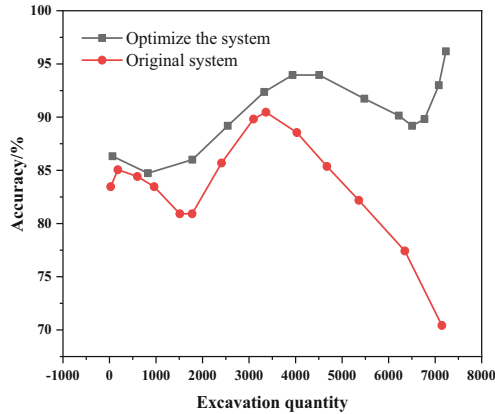
Fig. 3. Comparative results of two system experiments

5 Conclusion

In this paper, the SECI model theory is introduced into the interactive education information system, and the effective optimization of the teaching system is realized. At the same time, all hardware devices are optimized. From the design point of view, the functional module design of the system's user management module, homework management module, curriculum arrangement module, student status management module, examination management module, interactive evaluation module, and score management module is described. By analyzing the attributes of each entity class, the logical design of the database is finally completed. As an important way to realize the professional growth of teachers in the new era, this online learning community combines the two hot areas of teacher learning and the Internet. Combining the SECI model of knowledge management to build a network teacher learning community has important research significance for promoting the common development of network teacher learning.

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