Exploration of Teaching Support System Based on "Internet Plus"

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Abstract

Teaching support system is an important basis for improving teaching quality. This paper constructs a teaching support system for higher education by the Internet, Internet of things and its application in all walks of life. The research includes case resource database construction of three levels of system, inquiry teaching mode research, capability evaluation index and evaluation model research, network open platform construction and so on. By building a B-S based architecture of network open platform to verify the "Internet plus"-based teaching support system, practice shows that the teaching support system based on "Internet plus" can significantly improve the teaching effect, and meets the characteristics of the times oriented society for higher education.

1. Status Analysis on the "Internet Plus" Teaching Support System

"Internet plus" is an important part of the new generation of information technology [1], and is the third wave of the world information industry after the computer and Internet. "Internet plus" is a new format for the development of the Internet, and its scope of application covers almost all walks of life. In 2015, Chinese government work report proposed the development of "Internet plus" action plan, to promote the combination between mobile Internet, cloud computing, big data, networking and modern manufacturing industry, and to promote e-commerce, the Internet industry and the healthy development of Internet banking. In 2016, many enterprises and universities jointly promote the "construction engineering of Internet plus" to support the teaching system, which makes the "Internet plus" has become the hottest social topic.

Therefore, the teaching support system research based on "Internet plus" is an exploration to adapt the new requirements of the new age, and is the result of the rapid development and popularization for more than 10 years of the majors of Internet, networking and so on.

However, it appears the problems of "no case", "no teacher", "no base", "no result" in the course of constructing the "Internet plus"-based of high education teaching support system.

Firstly, the teaching of colleges and universities basically adopts the method of "close professional support" [2], which makes no or few cases in the classroom. Therefore, the teaching of related courses is seriously out of the social employment demand and the development of the Internet, Internet of Things and "Internet plus".

And then, teachers in Colleges and universities for the new "Internet plus" concept is still in the stage of exploration and learning, and there is no mature teaching case for reference, nor is there a stable teaching team to undertake teaching.

Thirdly, colleges and universities lack teaching bases for teaching relevant courses and

practice bases for conducting related experiments.

Finally, despite spending a lot of special funds to engage in the Internet of things, "Internet plus" teaching support system construction, however, due to the rapid development of Internet plus "technology and the existing teaching being out of the social reality, it leads to the related teaching results are very few.

In view of the existing problems of traditional concept of teaching support system in the above aspects, there is a need for a new type of teaching philosophy, which is supported by a wealth of teaching resources.

From the point of view of students studying, the teaching mode should provide them with a flexible way of learning and a wealth of learning materials, and they can carry out autonomous "guided" learning according to the principle of "intelligent guidance" [3]. This will expand the learning space, and can train the ability of independent study and inquiry learning.

From the point of view of teachers, the teaching mode should be helpful for curriculum development. On the one hand, teachers can carry out curriculum development for different teaching objects and teaching objectives, using templates, manuals and abundant materials; on the other hand, the curriculum developed by the teacher can also be used as a new case resource to enrich the teaching case resources database.

From the point of view of social workers, on the one hand, the teaching mode provides the enterprise with the functions of case resource retrieval, information inquiry, data downloading and personnel training; on the other hand, enterprises can also understand the situation of school personnel training and employment information through the teaching case database, and can release enterprise personnel standard. This mode has realized the organic combination of talent training, study and employment.

Therefore, the proposed "Internet plus"-based teaching support system research is significant. By collecting, arranging and organizing relevant cases, the teaching support system studies teaching methods, learning methods and experimental methods, as well as classification, feature extraction, content analysis, association reasoning and other techniques, and finally, a case base with intelligent inference function is developed. The case base can automatically select the cases according to the teaching needs, and can dynamically generate case based teaching plans, teaching purposes, teaching requirements, teaching content and requirements for experiments and internships.

2. Teaching Support System Based "Internet Plus"

The teaching support system based on "Internet plus"

relates to the case base construction based on "Internet plus", research on the teaching mode, students' ability evaluation research, and open network platform construction.

2.1. Case Base Construction Based on "Internet Plus"

Case base construction focuses on solving the difficult problem of selecting teaching cases. In the past ten years, many new things and new technologies have appeared, and their development is very fast. All kinds of new courses emerge in an endless stream. How to choose materials as a teaching case is a difficult problem to be solved.

(1) Select content related to the topic and use it as a case study, through classification, feature extraction, content analysis, association reasoning and other techniques. And had better combine the developed "dragon core networking development board and teaching kit", "case based framework of automatic generating kit", "3251 ARM networking technology teaching experiment box" and the participation in networking demonstration project.

(2) Analyze the teaching resources database in Colleges and universities: for the 5 kinds of mainstream resource repositories conduct investigation, namely, teaching resources database of higher education institutions in China [4], excellent course resource database [5], industry enterprise network college teaching resource database [6], online school teaching resource database [7], business website teaching resource database [8], and so forth. The survey covers the students, in-service staff, teaching and research staff, other social learners, etc. In the process of building the case resource database, from the planning design to the system implementation, from the system implementation to the management and maintenance of the entire life cycle, we should base on the user needs, and strive to practical, so that ensure the sustainable development of the case database and make the case resource database have a strong vitality.

(3) Conduct a survey of learning needs for the users of case base: Through the investigation, the learner's learning goals, learning methods and evaluation methods are clearly defined. And further, intelligently guide the learners to determine learning goals, provide rich learning content, point out learning methods, and give the objectives of learning evaluation. Through investigation, we can provide the idea support for the construction of curriculum case resource database.

(4) Targeted construct the three layer system structure, viz., "4+2+1" case resource base: "4+2+1" case resource base refers to the 4 core resources bases (capability standard database, module course database, training base, occupation qualification base) and 2 auxiliary resources bases (material database, employment guidance library) and 1 interactive network platform. As shown in Figure 1.
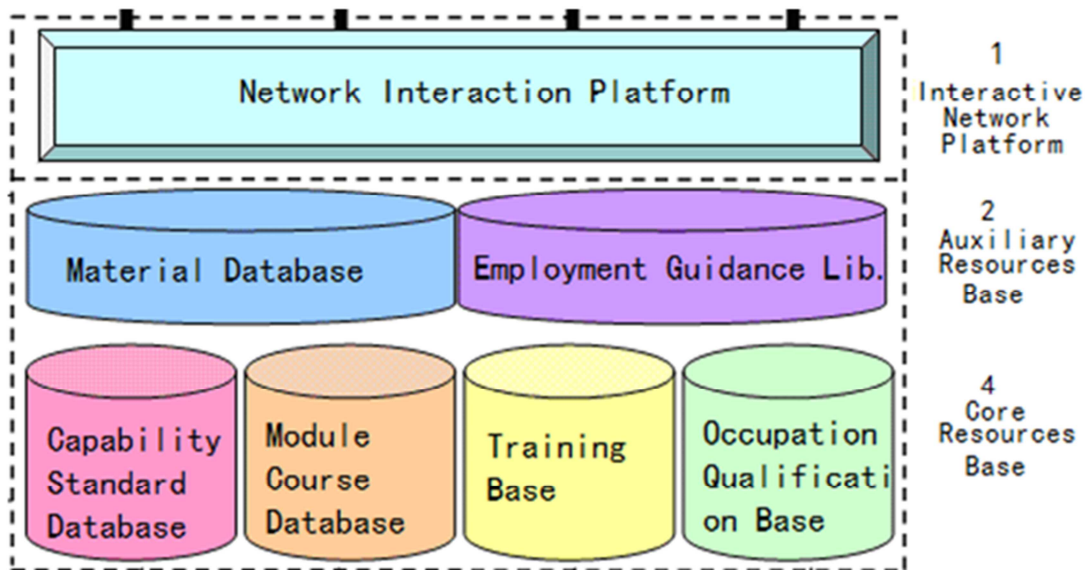
Figure 1. *Three Layer System Structure.*

In Figure 2, the bottom layer is the 4 core repository, the intermediate layer is the material database and the employment guidance Library, and the top layer is the network interaction platform.

2.2. Teaching Mode Research

The goal of teaching model research is to construct the comprehensive training model of ability standard, module course, learning and doing together, ability appraisal as a whole, and strengthen the inquiry teaching practice. This requires us to set up module courses based on the ability units to provide learning content, to learn and do everything on the basis of real project practice, to base on the needs of society to implement capacity appraisal and evaluate learning effectiveness. In the comprehensive training mode of "ability standard, module curriculum, learning and doing together, ability appraisal", competency standards correspond to career needs, module courses correspond to competency units, learning and doing together corresponds to projects, and competency identification corresponds to social needs.

In addition, the inquiry teaching based on the "Internet plus" requires teachers and students to participate in the study and Practice, and makes students from simple to complex, set goals and achieve goals, in the process of learning and researching the database technology and development tools. This creates a sense of accomplishment and motivates them to explore unknown knowledge.

2.3. Students' Ability Evaluation Research

In the teaching research, the model of "student ability evaluation" is introduced, and the temperament type test system, career tendency test system, mental health test and consultation system, etc are developed.

The student ability evaluation model has the function of learners' self learning and feedback. With the increasing number of testers, the model can better reflect the commonalities of students in this particular group, which can be used to guide them to improve their ability and accomplishment.

2.4. Open Network Platform Research

The network open platform embodies the characteristics of "advanced, easy to use, reliable and open", and the teaching case resource base will set up B-S network platform. From the hardware environment, system architecture and website system design, the open network platform ensures the reliable operation of the case resource database system. For medium-sized universities, it should meet the goal of 30 thousand learners online and 300 thousand learners a day.

3. Implementation of "Internet Plus"-Based Teaching Supporting System

3.1. Overall Plan

The implementation scheme centers on the "Internet plus", and explores the key issues of constructing teaching support system, which mainly explores four parts - the case based curriculum resource database construction, teaching model research, student ability evaluation model research, network open platform research. As shown in Figure 2.
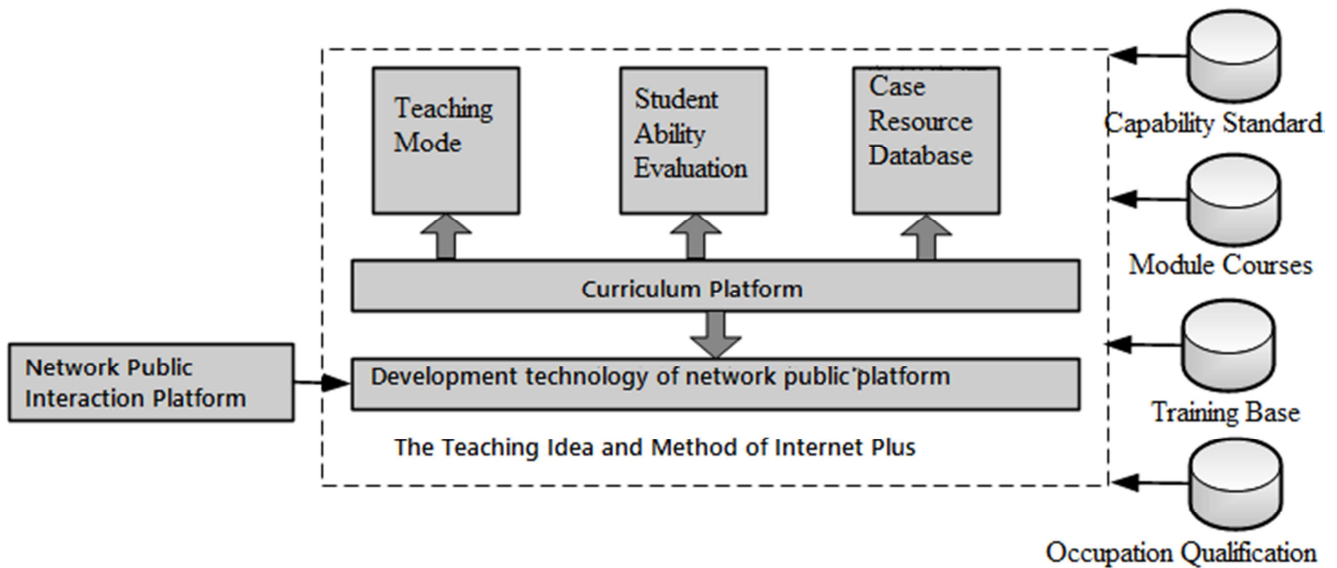
Figure 2. Overall Plan of New Teaching Support System.

The following sections are discussed separately.

3.2. Case Collection Construction of Classified Collection and Standard Management

Case database construction is of great significance for the effective teaching of the course, is the prerequisite of teaching support system based on the "Internet plus". Therefore, the analysis, integration and construction methods of case resource database should be studied, including three parts, "case resource analysis", "case resource integration" and "case resource database system construction"

(1) Case Resource Analysis

The construction of case base resources taking the technology and curriculum related to "Internet plus" as the starting point is the main method of this study. The case resources mainly include 23 categories: agricultural Internet of things technology, meteorological Internet of things technology, intelligent home system, environmental monitoring system, smart grid system, logistics technology, and expand on this basis.

Agricultural Internet of things technology [9]: the agricultural Internet of things technology, combined with sensing, cloud communications, cloud computing and other technologies, achieves the full life cycle monitoring and control of agricultural products, and provides a feasible way to solve the problem of food safety.

Meteorological Internet of things technology [10]: the meteorological Internet of things technology collects and monitors and controls the data in the meteorological field, to ensure the real time, accuracy and effectiveness of meteorological information.

Intelligent home system [11]: smart home control technology has made remarkable achievements in home security development. With the demand of enterprises and residential district becoming more and more obvious, digital intelligent security is facing new development opportunities; because of the particularity of digital intelligent security industry, the country pays special attention to it.

Environmental monitoring system [12]: Using environmental monitoring system to grasp the impact of landfill on the surrounding environment in a timely manner has become a vital issue related to the lives of the masses. When the city's intelligent environmental protection framework has been successfully established, it is not only convenient to collect data about the environment, but also to control the change of the environment in the whole area.

Smart grid system [13]: smart grid technology injects new technologies into the grid, including advanced communications technology, computer technology, information technology, automatic control technology and power engineering technology. Thus, the grid is given some artificial intelligence, so that it has a strong ability to respond, and becomes a fully automated power supply network.

Logistics technology [14]: logistics technology is an important field of information application. The informatization of logistics management and process monitoring can improve the efficiency of enterprise logistics and control the cost of logistics.

Other categories include intelligent mine technology, smart city technology, intelligent medical technology, city operation control, anti-terrorism security system, ocean situation system, etc.

(2) Case Integration

The various channels of the case are integrated, and then merged, processed. After confirmation by experts from industry and enterprise, the final case of teaching case resource database is obtained. According to the "social demand" and "similarity" principle, the resulting case is composed of capacity modules that dynamically generate relevant courses corresponding to capacity education programs.

(3) Case Resource Database Construction

The design of case resource database refers to the case database designed to meet the needs of students according to the application requirements. For large projects, the mere absence of database design for applications is nonexistent, so case database design is closely related to application programming. In a strict sense, case database design is part of the database application design.

The design of case data application system includes the structural design and behavior design, the structure design refers to the construction of case database, and the behavior design refers to the operation of a series of case database query, report output, data processing and mining, clustering, classification and so on. The structural design is carried out with the support of DBMS, and the behavior design is carried out with the support of the universal software development tool. Structural design and behavior design should promote each other and consult each other.

3.3. Research on New Teaching Mode

The research of teaching mode is of great significance to improve the teaching quality of the course. Taking the technology and curriculum related to "Internet plus" as the starting point, conduct the study of teaching mode, whose research contents include two parts: the "comprehensive training mode of ability standard, module course, learning and doing together, ability appraisal" and the "inquiry teaching method".

(1) Comprehensive Training Mode of Ability Standard, Module Course, Learning and Doing Together, Ability Appraisal

To meet the needs of society, develop ability standards and determine learning goals; based on competency standards, a module course is set and study content is provided; Relying on real project, practice to the learning and doing together, and point out the method of study; Based on the needs of society, professional appraisal was conducted to evaluate the effect of learning. In this comprehensive training mode, the goal, content, method and evaluation of the learning process are complete and unified, and closely linked with each other, where "professional posts, ability units, real projects and job demands" are directly related to "work", and "competency standards, module courses, learning and doing together, and professional identification" are directly related to "learning", which fully reflects the case based learning thought.
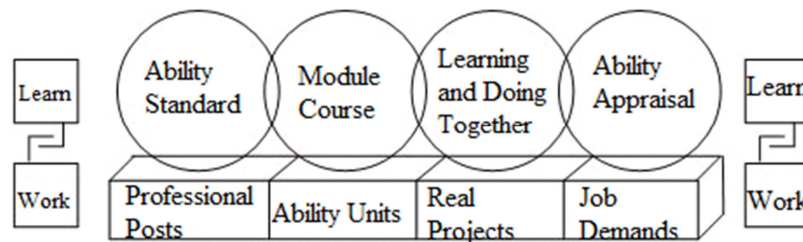

Figure 3. Mode of Ability standard-Module course-Learning and Doing together-Ability appraisal.

Analyze the students' category from four aspects: learning goal, content, method and evaluation, that is, access to different types of student learning needs to build 6 case resource bases: competency standard library, module course library, practice training database and professional qualification Library.

(2) Inquiry Teaching Method

Piaget thought, "The structure of cognition is neither pre formed in the object, because these subjects are always assimilated into the logical mathematical framework that is beyond the object; nor formed in the subject that must be constantly reassembled. Therefore, the acquisition of knowledge must be explained by a theory that closely links structuralism with constructivism. That is to say, every mental structure is the result of psychological development, and the psychological process is a transition from a primary structure to a less elementary one". According to Piaget's inquiry theory, teaching requires teachers and students to take part in the study in person, and let students in the process of learning, research and development, from simple to complex, set goals and achieve goals, and create a sense of accomplishment, and arouse their desire to explore unknown knowledge.

We should carry out the inquiry teaching practice at the level of the University and the level of society, especially the inquiry teaching practice of College Students, which mainly focuses on explaining the commonly used technology and common development tools. In the explanation process, increase the practice of special technology projects, and preset the default target, let the students gradually to explore the inner context of knowledge and key technology in the process of learning, and experience how theory embodied in the practice of technology. From 10~30's small class system to 60~90's big class system, they are divided into different groups to cultivate their team spirit and the spirit of scientific inquiry. The teaching practice and a large number of scientific researches show that: the "Internet plus"-based inquiry teaching research based on the scientific inquiry teaching theory is very effective.

3.4. Research on Student Competence Evaluation Model

The research of student ability evaluation model is of great significance for validating teaching effect, evaluating students' achievement, improving case resource database and enriching teaching methods. The research of student competence evaluation model includes two parts, "competence evaluation index" and "capability evaluation model".

(1) Competence Evaluation Index

In order to judge the students' ability, the research ability evaluation index is needed. The commonly used method is based on the field practice, which is chosen by experience, but this method is inefficient, error and not adaptive. Therefore, it is necessary to introduce the evaluation system based on Hebb Learning Rules [15], which is a dynamic adaptive evaluation system.

The evaluation system of Hebb Learning Rules consists of three parts: order relation algorithm [16], Hebb learning model and evaluation formula.

In the evaluation of order relations, if the evaluation index set $\{ x_1, x_2, x_3, \cdots, x_s \}$ is relative to an evaluation criterion, which has the following relation:

$$x_1^* > x_2^* > x_3^* > \cdots > x_s^* \qquad (1)$$

Then, call the evaluation index set $\{ x_1, x_2, x_3, ..., x_s \}$ to establish the order relation according to ">" [17], where x_i^* denotes the $\{ x_i \}$ to be i^{th} evaluation index according to the order of the ordinal relation ">" (i = 1, 2, …, s).

The Hebb learning model is a time - dependent dynamic model [18]. If $x_1, x_2, ..., x_s > 0$ and $y_1, y_2, ..., y_t > 0$, $w_1, w_2, ..., w_u$ is on the increase, and meets:

$$\begin{cases} w_{ij}^{new} = w_{ij}^{old} + \Delta w_{ij} \\ \Delta w_{ij} = \alpha f_i(x_1, x_2, ..., x_s) g_j(y_1, y_2, ..., y_t) \end{cases} \qquad (2)$$

Where, w_{ij}^{new} represents the new weight between the ith input and the jth output, w_{ij}^{old} represents the old weight between the ith input and the jth output, Δw_{ij} represents the increase of weight, α represents the learning speed and takes positive numbers, $f_i(x_1, x_2, ..., x_s)$ represents the composite function of $x_1, x_2, ..., x_s$, and $g_j(y_1, y_2, ..., y_t)$ represents the composite function [19] of $y_1, y_2, ..., y_t$.

The evaluation formula is:

$$y_i = \begin{cases} 1 & |x_i - x_i^o| < \varepsilon^- \\ \dfrac{\varepsilon^+ - |x_i - x_i^o|}{\varepsilon^+ - \varepsilon^-} \times 100\% & \varepsilon^- \leqq |x_i - x_i^o| < \varepsilon^+ \\ 0 & |x_i - x_i^o| \geqq \varepsilon^+ \end{cases} \qquad (3)$$

Where x_i is the ith indicator for students' ability assessment, y_i is the evaluation for x_i; specifies the standard value of x_i as x_i^o, and the maximum and minimum error threshold of x_i is $[\varepsilon^-, \varepsilon^+]$.

(2) Capability Evaluation Model

The student ability evaluation model includes the test set of competency model, information acquisition and storage module, information analysis module, information display module, information analysis module, rule base and so on. In order to design each component of the model, it is necessary to classify and analyze the students' behavior attributes, which should be combined with the characteristics of behavior and analyze the behavior data.

The test set of the evaluation model provides input sequences $x_1, x_2, ..., x_{sE}$, the weights $w_1, w_2, ..., w_{uE}$ of the test set are selected from the $w_1, w_2, ..., w_{uT}$ (uT>uE), and the output $y_1, y_2, ..., y_{tE}$ of the test set is calculated based on the input sequence and the discriminating criterion of the test set.

Information storage module online access behavior data, and according to the system requirements, storage information, which involves student's ID, start and end time participated in the test, knowledge module name, interactive link module name, the knowledge points involved in each technology, memory effect, practical grasp degree, feedback etc.

The information analysis module parses the information of the binary flow through the automatic analysis and reasoning of the student information [20].

The information display module displays the behavior data and the statistical behavior data through the visualization method, and uses the simulation method to display the learning behavior.

The information analysis module is an intelligent analysis and prediction of the students' ability evaluation data.

Rule base is the storage and management mechanism of all rules used for information analysis, including the rules of domain knowledge, rules of online learning, rules of weights given by experts, partial repetition rules, interval-valued fuzzy rules, etc.

3.5. Development of Network Open Platform

The network open platform exposes the case resource library and enables teachers, students and social users to use the case repository through the network open platform.

The development of network open platform using B-S architecture, by MyEclipse, Spring, Mybatis, EasyUI, SQL, Jquery, Server technology to develop the front and background of the system, which makes the network open platform with "advanced, easy to use, reliable and open". The features of the network open platform are as follows:

(1) Platform Reliability

According to the goal of 30 thousand people accessing online and 300 thousand people each day, the software and hardware scheme of the platform is designed; based on SQL Server +Windows 7 and multidimensional data mining technology, the stability, reliability and resource retrieval speed of the system is improved; according to the connotation of each theme database, establish a scientific and rational resource division standard; establish relationships between the underlying material and each topic resource repository to ensure the scientific nature of resource classification.

(2) Ease Use of the Platform

All kinds of learners enter the teaching case resource database system, and they all visit the resources by a visitor's identity without any role, thus eliminating the need for user registration for browsing resources. If you want to find the

resources you need, you can search for resources through an intelligent search portal, and give statistics of the resources you've found, such as, the number of downloads, resources-stars, resource size, resource format, etc.

(3) Advanced Nature of the Platform

Provide intelligent tutoring by taking learner's demand as the center. Learners can learn through the intelligent tutoring system of the resource base: after entering the intelligent tutoring system, the learner gets the relevant case resources of the ability unit according to his own identity, his learning goal and the ability to select the unit, and then, the system gives the case resources of recommendation study or the case resources chosen by the user to realize the intelligent tutoring.

(4) Implementation of Platform Openness

Classroom function in the air: learning mode, online test, self-study, online lesson preparation, online teaching and online communication;

Project: from the learner centered design the actual project column, let students participate in real project actual combat, play the team's technical level and cooperation ability.

Interactive community function: the resource sharing and technical discussions can be implemented through interactive communities. The bulletin boards, online skills competition, points exchange, resource sharing area, network laboratory construction zone, technical exchange zone, professional certification exchange area and teacher exchange area can be opened.

Personal space function: open personal space, and form a personal homepage system similar to BLOG, where you can post, send resources, download your own resources can also be stored in your personal space, you can also download to your own hard disk medium, and interact with other learners on the site.

Resource sharing function: through technical processing, share the site resources, and share it to QQ space, 163, SINA, and other forums, etc. If other users are interested in this resource information, click the resource link to access the teaching case repository.

Document map function: For the unlimited growth of teaching case resources, it is difficult to search for users directly, so document maps can be provided so that the learner knows what new additions are.

Intelligent retrieval function: it provides resource browsing, pre display, rendering, intelligent retrieval and so on. The system provides a variety of resource retrieval methods and retrieval strategies. The designs of general retrieval, compound retrieval, two search and full-text search, etc. can retrieve a variety of case resources to meet the needs of different users.

4. Conclusions

As mentioned above, the teaching supporting system based on the "Internet plus" can solve the problems of "no case", "no teacher", "no base", "no result" in traditional teaching. It can provide teaching cases of a specific technique according to the needs of teachers, can provide engineering cases of a certain

technology according to the needs of teachers, can quickly build relevant practice base based on this method, and can quickly verify the teaching effect and produce relevant results relying on this method. The teaching support system based on the "Internet plus" has changed many disadvantages of the traditional teaching methods, and improved the initiative and enthusiasm of students' learning, and trained their ability to analyze and solve problem.

Acknowledgements

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