Construction of Network Course System of Construction Machinery Specialty Based on Cloud Class

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Abstract. At present, the learning module of online courses for engineering machinery majors is chaotic and data storage is not timely, which leads to the defect of low knowledge conversion rate in online courses. Aiming at this problem, a new network course system for engineering machinery specialty based on cloud class is designed. Based on modular curriculum structure, level of course phase steps and coordinated network curriculum development process design process, and on this basis, from the perspective of learners, design a cloud platform network curriculum content, making learning modules, design of the real-time database storage system, strengthen network curriculum knowledge conversion, finally realizes the operation of the network curriculum system, major in engineering or mechanism. The experimental results show that: compared with the traditional three kinds of network course system for engineering machinery, the network course system for engineering machinery designed in this paper has greatly improved the knowledge conversion rate, which fully shows that the network course system for engineering machinery has better application performance.

Keywords: Cloud class · Construction machinery · Network · Courses

1 Introduction

In the modern society of informationization, great changes are taking place in every aspect. Under the background of the development of computer technology, network technology and modern education theory, education is gradually showing the characteristics of digitalization and networking. As an information-based education model, web-based course has become an important aspect in the field of educational technology, and it has gradually become an effective form of lifelong learning. The network course breaks the traditional mode of listening in the classroom in the past, and is more beneficial to the learners to study. It not only provides abundant learning resources, but also enables the learners to get rid of the limitation of time and place, and can arrange the study autonomously according to time in the study. On the other hand, from the teacher's point of view, the environment of the network course can provide the teachers with a free

S. Liu et al. (Eds.): eLEOT 2020, LNICST 339, pp. 88–98, 2020.
https://doi.org/10.1007/978-3-030-63952-5_8

and up-to-date teaching platform. The network course system can also help the teachers to track the students' learning progress and degree of mastery in the teaching activities, and provide corresponding technical force support for the teachers. Through this system, the teachers can monitor the whole process of the students' learning to make the best response [1].

Engineering Machinery is an applied subject that studies and solves all the theoretical and practical problems in the development, design, manufacture, installation, application and repair of various machines. This major prepares students to master the basic knowledge and application of mechanical design, manufacturing, electromechanical engineering and automation. It prepares students to engage in the research, design, manufacturing, control and programming of various machinery, electromechanical products and systems, equipment and devices, the development of numerical control equipment, computer aided programming, the design, manufacture, development and application research of advanced technical products and systems such as industrial robots and precision electromechanical devices, intelligent machinery, micromachinery and power machinery, as well as senior engineers and technicians engaged in technical management in scientific research institutes, enterprises, and advanced technology companies. The educational results of engineering machinery professional courses play a vital role in national development [2].

According to the existing research results, there are three widely used systems: Moodle based network course system, Cloud based network course system and UCD based network course system. The above three systems have the defect of low knowledge conversion rate. Therefore, this paper puts forward the construction of engineering machinery specialty network course system based on cloud class. Cloud class is a new teaching mode. Cloud class refers to the teaching form that teachers prepare lessons, classroom teacher-student interaction, assignment and other steps are concentrated on the cloud service platform. Cloud classes as the basis for the construction of engineering machinery professional network course system, for the construction machinery professional training to provide more powerful support.

2 Network Course System for Engineering Machinery Specialty

2.1 Network Course Process Design

Process refers to a series of actions which are purposeful, repetitive and stylized, and which rationalize, transparent and consensus tasks in a series of forms. Cloud class is a new teaching mode. Therefore, the first step is to use the design process of cloud class to replace the single course design process of teachers in traditional one-off course design. After summing up, the design of network course flow of engineering machinery specialty is divided into three steps, which are modular course organization, hierarchical course stage and collaborative course development [3].

Among them, modular curriculum organization refers to the course development process based on the characteristics of cloud class, which is divided into curriculum planning period, curriculum production period and curriculum operation period. Each module is listed in the work of the module tasks, as well as the completion of the task

required to do the course preparation, so that teachers can more clearly understand the process of curriculum production, as shown below (Fig. 1).

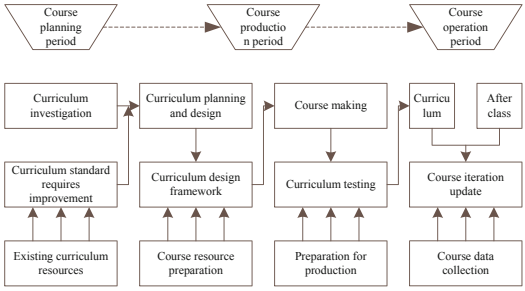

Fig. 1. Organizational Structure of Modular Courses

After the modular design of the organizational structure of the web-based courses, the specific steps of each module need to be further clarified. Therefore, the development design of each stage of the course needs to be broken down into multiple steps and the tasks required for the course development need to be understood more clearly [4].

Based on the "Five in One" theory, the schematic diagram of the "Five in One" theory is shown in the following figure.

As shown in Fig. 2, the five design elements of people, action, purpose, scene and media fully embody the ideological connotation of the theory of "Five in One". Applying the viewpoint of "Five Elements of Design" to Network Course Planning, this paper points out that the five elements of learning crowd, learning scene, learning content, learning aim and learning form should be defined. Students majoring in construction machinery need to be involved in the determination of these five points. Students majoring in construction machinery need to propose their expected learning contents, learning scenes, learning forms and learning purposes.

Based on the learner's curriculum expectation and curriculum indicators, the final curriculum design framework is established, including curriculum content design framework and user experience framework. The curriculum content framework includes the curriculum chapter catalogue, the curriculum innovation spot, the curriculum heavy difficulty analysis, the curriculum examination standard four points, the user experience framework includes the curriculum experience system, the curriculum interaction system, the curriculum feedback system three points, as shown in the following figure (Fig. 3).

The collaborative curriculum development process needs to be implemented in various steps. For example, when the user groups of the courses are investigated, the characteristics of the major learning groups will be displayed according to the collected data, and then the user portrait will be made. When the volunteers recruited for the courses are subsequently to participate in the curriculum content design and course experiment, the major learning groups will be recruited according to the user portrait of the initial major learning groups; according to the learning objectives and learning methods of the pre-curriculum design, the learning methods will be determined based on the

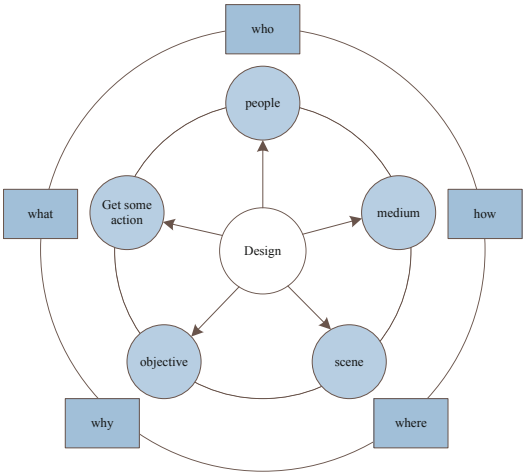

Fig. 2. Schematic diagram of "Five in One" theory

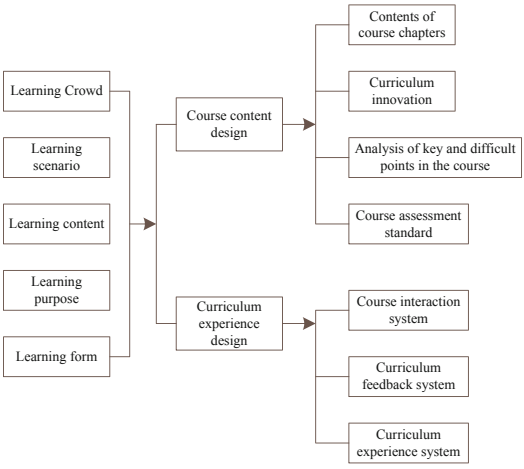

Fig. 3. Level of Course Stage Steps

platform for the course opening and the design of the courses, and the investigation on the platform for the course opening and the teaching methods of the same type of the courses in the pre-curriculum design and feedback system; in the course experience design and feedback system, various teaching services will be provided according to the network platform, which will greatly help the design of the course content and services in the future. Therefore, in the process of curriculum design, establishing the relational structure of the curriculum, we can find the real needs of students, and then update the curriculum content [5].

2.2 Network Course Content Design

From the angle of the learner, the content of the network course of engineering machinery specialty needs to add the learner's goal demand and content demand to the existing teaching index and course content. Content design is divided into three steps, respectively, 1) to determine the learning population; 2) to obtain the content of user needs; 3) integration of teaching materials and user needs. The content of the three steps and the tools or methods required to complete them are described in detail below [6].

Determining the study crowd only needs to locate the university in the construction machinery specialized student, the step is simpler, does not do excessively elaborates.

Methods for obtaining user course content requirements are shown in the following table (Table 1).

Table 1. Method of acquiring user course content requirements

Method	Brief introduction	Access way
Diary research	By recording the user's behaviors and ideas in daily life, this paper summarizes the user's background, lifestyle, interests, habits and other characteristics	Notes, email, platform message board, social media, etc
survey by question naire	Through the design of relevant issues about the research content, users can receive quantitative or qualitative data collection methods	Questionnaire distribution and recovery
User interviews	User interview can intuitively and deeply understand the needs of learners for course content	Direct conversation for information
Card sorting	Participants were invited to write down their understanding of the content on the cards printed with the relevant links or objects of the product, and organize and classify the cards	Card issuance and recovery
QFD method	QFD method can transform user requirements into design requirements, calculate key design requirements and optimize resource allocation	Card analysis

Integrating the content of textbook and the content of users' needs, we first select the real needs of most of the users' feedback, and then select the content needs of the network course syllabus for the specialty of construction machinery again, then add these user needs into the course design plan, integrate the course content and user needs, and

design a testable prototype of the course. Then the feasibility of the course prototype is tested and the learners are invited to experiment to verify whether it meets their real needs [7]. Finally, according to the results of the test on the course iterative design, the design of a sound engineering machinery professional network courses.

2.3 Learning Module Design

According to the teaching demand of engineering machinery major, the learning module of web-based learning course is divided into seven modules: teaching item, teaching design, exercise question 1, exercise question 2, assignment, interactive evaluation and learning experience. According to the engineering machinery specialized teaching information design carries on the overall contact surface the design work, its concrete content including the character, the color, the contact surface [8].

In order to make the teaching content more vivid and vivid, the author joins the module of teachers' teaching video and tries to increase the diversity of the learning content. Cloud classes can be directly through the upload control to add video modules, and through the PHP code settings can be uploaded locally to control the video size of about 1 GB, which greatly relaxed the teachers upload video space restrictions. The educational effect of video is more intuitive and deeper for students, so this function is particularly important.

In addition, the interactive evaluation sub-module is also crucial. Interactive evaluation includes two kinds, one is the mutual evaluation between students, the other is the teacher evaluation, cloud class evaluation function, voting function is very effective. One of the motives of continuous learning is to arouse students' enthusiasm for learning by evaluating the learning results. The evaluation indicators within the evaluation function are not invariable, on the contrary, corresponding adjustments may be made according to the needs of the actual situation, and the evaluation results shall be reflected and counted immediately, so as to enable teachers to control the situation of students and obtain first-hand learning feedback in the shortest time. The evaluation covers a wide range of fields, including teachers, students and students. The evaluation covers a wide range [9].

The teaching evaluation system is shown in the table below (Table 2).

Table 2. Teaching Evaluation System

Essential factor	Achievement		Weight
	Yes	No	
Essential factor 1	–	–	1
Essential factor 2	–	–	1
Essential factor 3	–	–	1
Essential factor 4	–	–	2

2.4 Database Design

Database is the key module of the network course system of engineering machinery specialty. Its main function is to store and save the task information, course information and course content information.

The task information is shown in the following table (Tables 3, 4, and 5).

Table 3. Task information

Field name	Data type	Length	Key
Task ID	Unique identifier type	–	Primary key
Task category	Character	10	no
Task title	Character	50	no
Course ID	Character	10	Foreign key
Node ID	Character	10	Foreign key
Release time	Time type	–	no
Deadline	Time type	–	no
Task content	Character	2000	no
Task score weight	Character	2	no
Associated task ID	Character	10	Foreign
Associated topic ID	Character	10	Foreign

Table 4. Course Information

Field name	Data type	Length	Key
Course ID	Unique identifier type	–	Primary key
Course category	Character	10	no
Course title	Character	50	no
Teacher ID	Character	6	Foreign key
Assistant ID	Character	60	Foreign key
Release time	Date type	–	no
Opening hours	Date type	–	no
End time	Date type	–	no
Course introduction	Character	2000	no
Home page recommendation or not	Boolean type	–	no
Course status	Boolean type	–	no
credit	Character	2	no
Key word	Character	50	no

Table 5. Course Content Information

Field name	Data type	Length	Key
Content ID	Unique identifier type	–	Primary key
Task ID	Character	10	Foreign key
Content category	Character	10	no
Content headings	Character	50	no
Content information	The binary type	–	no
Node ID	Character	10	Foreign key
Release time	Time type	–	no
Effective time	Time type	–	no
Number of visits	Character	10	no
Whether to associate scores	Boolean type	–	no
Task score weight	Character	3	no

Through the above process, the construction and operation of the network course system of construction machinery specialty is completed, which provides a new form for the training of construction machinery professionals [10].

Through the above process, the construction and operation of the network course system for construction machinery speciality have been completed, providing a new form for the training of construction machinery speciality.

3 System Testing and Effectiveness Analysis

3.1 System Performance Testing

The system performance test mainly carries on the comprehensive examination diagnosis to the construction machinery specialized network curriculum system based on the cloud class class class, the test goal is as follows:

One is to find out and correct the system problems as far as possible, find and solve the system loopholes. Enable the system to run effectively for a long time to prevent the occurrence of predictable security problems;

Second, check whether each functional module meets the basic requirements for ensuring the smooth operation of the system, whether the functional realization is complete, and put forward opinions on modifying and adding new functions according to the test;

Third, whether the system's performance meets the initial requirements, whether the basic user experience to meet the requirements;

Fourth, the requirements of data integrity and consistency, correctness of form verification, link accessibility, cloud class setting and normal interaction of interface.

The login test table is shown below (Table 6).

Table 6. Login Test Sheet

Function	Test point	Test result
Sign in	Registered account, correct password	Successful login
	Registered account, wrong password	Display error
	Log in with an unregistered account	Display error
Cancellation	Interface prompted to return after background management logout	yes
	Only partially refresh the login module after learning the relevant page to log out	yes
Other	Whether the user successfully logs in to the corresponding interface	yes
	Use back and refresh after successful login. Do you want to keep login	yes
	Whether keyboard control login is supported	yes
	Use verification code for login	nothing

Cloud class interface test, the test home page is shown below (Fig. 4).

Fig. 4. Schematic diagram of the test main page

Through the test results, we can see that the network course system of construction machinery specialty is feasible and can be carried out smoothly.

3.2 Selection of Experimental Indicators

Students will be graded for each of the four phases of the course. In each stage of the performance scoring, teachers will be each student's work were four indicators of

scoring, scoring standards for the full 10 points, the lowest 0 points, 1–3 points for the poor, 4–6 points for good, 7–10 points for each stage of the student performance data statistical analysis.

Knowledge conversion rate refers to the degree of effectiveness of online courses. The formula is

$$\zeta = \frac{\sum_{i=1}^{4} t_i}{n} * \delta \tag{1}$$

Among them,ζ represents knowledge conversion;t_i represents the scoring value for each stage;δ indicate the score t test results.

3.3 Analysis of Experimental Results

The performance of the system is demonstrated by the conversion rate of knowledge, which is compared with the existing Moodle-based, Cloud based and UCD based Engineering Machinery Specialty Network Course.

The knowledge conversion ratio obtained from the experiment is shown in the following table.

As shown in Table 7, the knowledge transfer rate of the design system is much higher than that of the existing three systems, with a maximum of 92%.

Table 7. Comparison of Knowledge Conversion/%

	System based on cloud class	Moodle based system	System based on cloud platform	UCD based system
10	89	65	45	46
20	80	61	43	44
30	87	59	40	51
40	86	55	49	48
50	90	66	48	52
60	91	67	48	60
70	91	68	52	54
80	92	60	51	51
90	90	77	56	42
100	89	54	49	44

According to the experimental results, compared with the existing three systems, the designed system greatly improves the knowledge conversion rate, and has better performance.

4 Closing Remarks

This paper puts forward a new network course system for engineering machinery specialty aiming at the common defects of traditional network course learning. Into cloud class class technology, based on the modular curriculum structure, level of course phase steps and co-ordinated network curriculum development process design process, and on this basis, the design of a cloud platform network curriculum content, making learning modules, strengthen network curriculum knowledge conversion, real-time database system is designed, finally realizes the operation of the network curriculum system, major in engineering or mechanism. The experiment verifies that the system designed in this paper has greatly improved the knowledge conversion rate and has better teaching effect. However, due to the small amount of experimental data, the experimental conclusions still need to be verified. Therefore, further optimization of the design system is needed in future studies.

Fund Project. Research Project on the Modern Education Technology of Jiangsu Province (Project No.: 2019-R-74828).

References

1. Sorrentino, F.S., Matteini, S., Bonifazzi, C., et al.: Diabetic retinopathy and endothelin system: microangiopathy versus endothelial dysfunction. Eye (Lond). **32**(7), 1157–1163 (2018)
2. Alcantara, J., Nazarenko, A.L., Ohm, J., et al.: The use of the patient reported outcomes measurement information system and the RAND VSQ9 to measure the quality of life and visit-specific satisfaction of pregnant patients under chiropractic care utilizing the webster technique. J. Altern. Complement. Med. **24**(1), 90–98 (2018)
3. Rachel, B., Will, W., Susan, R.: T63 towards a comprehensive semantic memory netliminary results using magnetoencephalography (MEG) in schizotypy. Schizophr. Bull. **44**(suppl_1), S138–S139 (2018)
4. Frederico, N.L., Eduardo, S.H., Humberto, A.J.: A blended learning method applied in data communication and computer networks subject. IEEE Latin Am. Trans. **16**(1), 163–171 (2018)
5. Mu, D., Wang, G., Fan, Y., et al.: Study on course keeping of POD propulsion unmanned surface vessel. J. Harbin Eng. Univ. **39**(2), 274–281 (2018)
6. Zhang, X.S., et al.: Antibiotic-induced acceleration of type 1 diabetes alters maturation of innate intestinal immunity. Elife **7**(e37816), 1–37 (2018)
7. Wang, R., Jiang, B., Liu, J.: Fault estimation and accommodation for a class of nonlinear system based on neural network observer. Trans. Nanjing Univ. Aeronaut. Astronaut. **35**(2), 318–325 (2018)
8. Mangalathu, S., Heo, G., Jeon, J.S.: Artificial neural network based multi-dimensional fragility development of skewed concrete bridge classes. Eng. Struct. **162**(1), 166–176 (2018)
9. Sheroug, A.A., Zeinab, A.M., Banazier, A.A.: Brain tumor classification using principal component analysis and artificial neural network. J. Clin. Eng. **44**(2), 70–75 (2019)
10. Cimellaro, G.P., Marasco, S., Noori, A.Z., Mahin, S.A.: A first order evaluation of the capacity of a healthcare network under emergency. Earthq. Eng. Eng. Vibr. **18**(3), 663–677 (2019). https://doi.org/10.1007/s11803-019-0528-3