

Teaching Design Practice of Microlecture Based on Knowledge Point

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Abstract—This paper has promoted the teaching design mode of microlecture based on the knowledge point by learner-centered. By using smart technology and various format of resources including mobile learning, it has formed the knowledge network at multi-level and overall coverage that adapted to diverse learning styles. It comes true that the interaction and resource sharing among learners and teachers, learners and learners. The course structure is based on knowledge point and the length of video for each unit is about 15 minutes. This teaching design mode of microlecture has been applied to the teaching practice and has achieved positive effects. The online course application of Reinforced Concrete Structure is an example for this paper.

Keywords- teaching design; knowledge point; microlecture

I. INTRODUCTION

With the rapid development of modern information and communication technology, it has become a trend in the development of education by sharing high quality of the course resources around the world. Massive open online courses (MOOCs) had been attracted considerable attention^[1]^[2]. There had been new challenges and great influence on traditional education since 2010^[3]. A project called "edX" plan has been implemented by Harvard University and the Massachusetts Institute of Technology (MIT). It offered free online courses to any places especially to the developing countries and regions, and provided higher quality education to the public. "We're bringing the best of higher education to students around the world. edX offers MOOCs and interactive online classes in subjects including law, history, science, engineering, business, social sciences, computer science, public health, and artificial intelligence (AI)." ^[4]

In October 2012, a plan of high-quality courses construction which course resources should be shared in the national network was launched by the Ministry of Education of China. The college of continuing education of Tongji University took part in it. And it has formed the teaching design mode of online courses with its own characteristics. It is conducted by the learner-centered concept, analyzing teaching objective according to the syllabus. The learning contents are based on characteristics, such as the learners' fragmented time and so on. The learning units of the course are divided by knowledge point, and each video of

microlecture is about 15 minutes-length. The core of the teaching design is the presentation of teaching resources and the organization of learning activities. Learners can learn autonomously more convenient through the design of learning situation, learning strategies and learning support services. This teaching design of microlecture has been applied to the teaching practice, such as Reinforced Concrete Structure, General Physics, Engineering Cost Management, etc. And it has achieved positive effects.

II. BACKGROUND

The development of modern information and communication technology has changed rapidly. D.R.Garrison & Terry Anderson (2008) pointed out the importance of the interaction and education technology in open and distance learning^[5]. A new kind of online courses which named microlecture is coming into people's vision, and is increasingly concerned by the people.

The concept of microlecture was first made by David Penrose, who was the senior designer and college teaching online service manager of San Juan College in New Mexico in the United States of America in the autumn of 2008^[6] ^[7]. It refers to the practical teaching contents which is using of constructivist approach, by the way of online learning or mobile learning. The microlecture is generally within 1 to 3 minutes-length, and has short clear teaching contents. And it has an outstanding subject. It is easy to use. There are some common types of microlecture such as PPT, tablet, micro video, micro audio, etc.

Penrose promoted five steps of constructing the microlecture^[8]:

- Listing the core of concepts which should be transmitted to the students in the teaching object.
- Writing an introduction, providing the context background of the core concepts.
- Making a scene video of the above contents recorded by microphone or camera shooting.
- Designing the guidelines or tasking to the students to read after class.
- The video and task should be uploaded to the courses management system in the network.

The unit of microlecture often contains one or several knowledge points. The knowledge point was the basic

transmission unit of the information of the course and the smallest unit of course knowledge structure^[9]. Each knowledge point has a relatively independent topic, and there has a certain relationship between the different knowledge points. Each course is a knowledge structure system composed of several interrelated knowledge points^[10].

The emergence of microlecture may subvert the traditional teaching mode in classroom and learning style. It is an important education reform that the structure of teaching turns the type of teaching before learning into learning before teaching. With the support of technology, every learner can obtain information resources in a short time and get more learning opportunities through the microlecture. The learners can develop their activities of learning, and can find the knowledge points which they want to learn. This can save the learning time. It reflects the learner's personal learning which needs to learn at any time and anywhere in the information era.

This paper puts forward to the teaching design mode of microlecture based on knowledge point, and is consistent with the change of the teaching mode.

III. THE IDEA OF THE TEACHING DESIGN

The idea of the microlecture teaching design based on knowledge point is derived from the humanistic theory and constructivist learning theory. Humanistic theory is based on humanistic psychology by A. Maslow and C. R. Rogers. It emphasizes not only the learner as the center, but also the teachers' leading roles^[11]. This theory emphasis on person's values. It focuses on the learner's non-intelligence factors such as emotion, interest, motivation and so on. It also focuses on learners' growth, progress and encourages to autonomous learning. By constantly motivating learners' learning enthusiasm and mining potential in the learning process, learners can feel the pleasure of learning and understand their own values, and can achieve the purpose of themselves^[12]. At the same time, the humanistic theory plays an important role of interpersonal relationship in the teaching process. It emphasizes the communication between teachers and students. Through establishing a harmonious relationship between teachers and students, teachers can play the better role of learning facilitators.

Constructivist learning theory believes that learning is the process of actively construct knowledge, not simply passively receiving of information. It emphasizes the learners' initiative and construct in learning process. The learning process is a construction of new information. On the other hand it also contains the original experience and knowledge reformed and reorganized. On the basis of original knowledge, every learner has new information coding in order to construct his own understanding. The theory puts emphasis on the construction of knowledge derived from the activities, and knowledge exists in activities. "Learning activity situation is the growing point of knowledge and retrieval cues"^[13]. Traditional teaching designs pay more attention to the certainty and universality of knowledge, and focus on analysis and abstraction.

Constructivist learning theory, which proposes collaborative learning and situational teaching, etc., is considered to be the theoretical foundation of reforming the traditional teaching.

This paper applies the humanistic theory and constructivist learning theory to teaching design in practice. It emphasizes the learner-centered and the reconstruction of the knowledge. These are the theoretical foundation of the teaching design mode of microlecture based on the knowledge point in this paper.

IV. THE TEACHING DESIGN MODE AND ITS CHARACTERISTICS

The teaching design mode refers to the design of teaching activities and structure under the guidance of the framework in the theories and the practice of learning situation in order to achieve certain teaching object. The core of the teaching design under the concept of learner-centered is the representing of teaching resources and the organizations of learning activities. Learners can learn autonomously more convenient through the design of learning situation, learning strategies and learning support services.

A. *The Teaching Design Mode*

The teaching design mode of microlecture based on knowledge point which this paper suggested has five steps.

First, confirming the learning contents based on the analysis of teaching objective and learners' characteristics. And partitioning the knowledge and giving the navigation to the learners.

Second, the presentation of teaching resources and the organization of the learning activities in the course should be opened and shared. And combine the basic resources with expanding resources and dynamic resources. At the same time pay more attention to the design of the learning situation and learning strategies.

Third, upload the course resources online and it should be opened and shared.

Fourth, learners can use a variety of learning styles to autonomous learning, such as by e-book or mobile learning, etc.

Finally, the learners take an autonomous learning way to learn by themselves, and check out the learning outcomes through the formative and final assessment.

The teaching design mode is shown as figure 1.

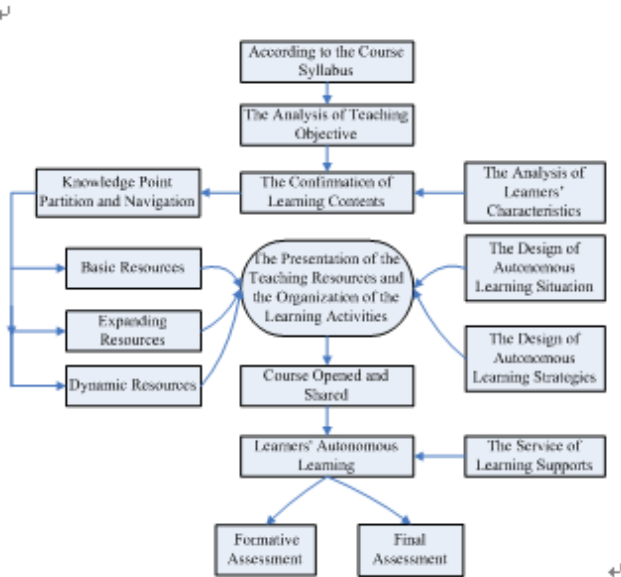


Figure 1. The teaching design mode of microlecture based on knowledge point.

B. The Characteristics of the Teaching Design Mode

Compared with the general teaching design, the teaching design of microlecture based on the knowledge point has the following characteristics:

- It breaks the traditional concept of the chapter, and the learning units are divided by the knowledge point or the knowledge module;
- The knowledge point structure is clear and focused on the learning content designed and organized by the microlecture about 15 minutes-length;
- It provides knowledge network of multi-level and full coverage adapted to the needs of different learners;
- It strengthens the teachers-students interaction and students-students interaction through using a variety of interactive ways ;
- It enhances the learning process management through monitoring the learners in their learning time and learning interactions;
- It realizes diverse learning styles including mobile learning and epub by using the modern information and communication technology. And it fulfills the requirements of learning society in "Learning can be happened in anyone, anytime and anywhere". And it provides the learners good experiences.

V. THE EXAMPLE OF CASE

The application of the online course of Reinforced Concrete Structure is an example for this paper. It shows the meaning of the teaching design mode of microlecture based on knowledge point, and has the positive effects in the past three years.

A. The Analysis of Teaching Objective

The course of Reinforced Concrete Structure is one of the important professional courses in the major of civil engineering in adult education. Through learning this course, the learners should master the basic calculate principles of reinforced concrete and the structure design methods. The learners should understand the design standard of reinforced concrete structure designing and its background. And they should also have the abilities of solving the actual engineering problems.

B. The Analysis of Learners' Characteristics

The knowledge backgrounds of the adult learners are different from others, and their basis knowledge is also inferior. The learners have the pressures from both the working and families. Not only do they spend much time on learning, but also be no more interested in learning. It's difficult to focus on learning in the classroom because of the learning centers scattered round the country. And there are no more communications between teaching and learning. Otherwise most of the learners pay more attention to the practicability of the knowledge than learning the theories.

C. The Confirmation of Learning Contents

There are some principles of the confirmation of learning contents. First, you should consider the characteristics of the learners. Second, the course contents should be covered the whole basic concepts and the key points should be outstanding. Third, simplifying the theory derivation and strengthening the practice applications properly. Fourth, each unit consists of 3 knowledge points and the length of each video is about 15 minutes. At Last, there should be plentiful learning resources in order to form the knowledge network of multi-level and full coverage in order to satisfy the requirements of the learners.

After confirming of learning contents, the knowledge points should be partitioned. And the structure chart of the knowledge point shows the relationships of knowledge point one another. This can help the learners find the knowledge which they want to learn conveniently and accurately. The course has 80 videos containing 240 knowledge points. It can help the learners to master the basic requirements well.

The structure of the knowledge point demands the full coverage of the course. And it demands to provide the expanding knowledge which combining the development of the subject. The learners should finish learning the knowledge of basic resources firstly. And then they can learn the knowledge of expanding resources. The resources produced by the process between the teachers and learners, or the learners and the learners are admitted into the dynamic resources.

D. The Presentation of Teaching Resources and the Organization of Learning Activities

- The Presentation of teaching resources. There are three kinds of resources in teaching resources. They are basic resources, expanding resources and dynamic resources. The mode of the teaching resources Presentation is adapted to the diverse learning styles, including mobile learning.

Basic resources. The basic resources indicate the resources which the learner should grasp the basic knowledge according to the teaching objective including syllabus, teaching module and knowledge points, key points, reference documentation, term dictionary, videos, PPT, homework, cases, testing, navigation, engineering projects, E-book, achievement and so on.

Expanding resources. The expanding resources indicate the resources arranged for the learners to expand their visual fields of their knowledge, including experimentation, principle cartoon, special lecture, knowledge warehouse and so on.

Dynamic resources. The dynamic resources indicate the resources which produced by the teachers-learners interaction or the learners-learners interaction. They are including online exercises, online questions, excellent homework, learner's garden and so on.

- The organization of learning activities. The organization of learning activity is related to design of learning situation and learning strategies.

The design of learning situation. The design of learning situation indicates the environments which set by learning knowledge and technical ability. The learning situation in this course stress that the knowledge show should be applied in real practice, and also stress the learning through interaction and cooperation. At the beginning of the semester, the teachers explain the learning methods and course guidelines. There is a guidance of learning online. And the teachers organize the learning groups to discuss the special subjects. The learners should do homework for three times at least in the semester, and submit the homework online through the column of "my homework" at first. Then the teachers check them and return to the learners online, and put the excellent homework on the network to show. The learners ask the questions online through the column of "my question", and the teachers reply to them online through the column of "my teacher" every week. If there are some representative questions, the teachers set them to the column of "learner's garden" to arrange the learners to discuss them. The learners can test the learning effects through the column of "simulating test" by themselves at ordinary times, and should have the final examination at the end of semester.

The design of learning strategies. The design of learning strategies indicates the programs of orders, methods, forms which served the learner to achieve the learning objective. The learners act their own by learning courseware, doing homework and exercises. At the same time they accept guidance by the teachers. According to the teaching-learning guideline, the learners can act on their own on learning. Because of the microlecture which videos are recorded by knowledge point and have just about 15 minutes- length, the learners can take advantage of short times to learn.

E. The Service of Learning Supports

The service of learning supports has two styles. One is the academic service of learning supports, and the other is the non- academic service of learning supports.

The academic service of learning support is provided by the tutors. The online courses offer the teaching resources of the academic service, including navigation, videos, PPT, term dictionary and knowledge warehouse. The academic service between the teachers and learners includes the column of "online questions", "my homework", "my student", "my question", "learner's garden" and so on. It can help the teachers to know the learner's situation and guild them more effective. The conversations between the teachers and learners, or the learners and learners are actualized through Email or QQ. Otherwise the tutors take part in the learning process and check the learner's homework.

The non-academic service of learning support is provided by the staff in the college. They give the answers to the learners about the non-academic questions, such as enrolment and so on.

F. The Assessment of Learning Outcomes

The assessment of learning outcomes consists of two types, including formative assessment and final assessment. The formative assessment can be carried out not only by the teachers, but also by the learners themselves through the self-assessment systems.

The final assessment is used to evaluate the learning outcomes through the final examination at the end of the semester. The covering surface of the final examination contains all of the basic knowledge point of the syllabus. The forms of the examination questions contain concepts and case analysis. It demands the learners to think deeply and make judgment based on study. It prevents the learners from memorizing mechanically. The examination questions are extracted from the question bank automatically and the questions for each learners are different. So it can avoid the learners cheating in the final examination.

G. The Positive Effects in the Practice

- The online course has been opened and shared by the learners inside and outside of the college. It had been opened online for free and had been applied widely since 2010. And has positive effects from the learners. Here are some evaluations of the learners:

Teachers gives us wonderful videos of teaching and engineering practice in this online course. And let us contact the theories with the practice. We can understand the knowledge of the teaching material well and be more interested in course of Reinforced Concrete Structure. And it will help us establish good basic theories for working.

This course gives us more pictures and videos, such as the operational principles of the hoisting machine in the workshop. The complicated knowledge can be explained vividly by three-dimensional cartoons. And let us master the operational principles of the hoisting machine easily. In a word, combining the videos, cartoons and words make us learn lightly.

- The distribution of the learners' scores becomes more reasonable. Comparing with the past scores, the average scores had been improved in the past three years.

And the rate of failing goes down. Here is the distribution of the learners' scores.

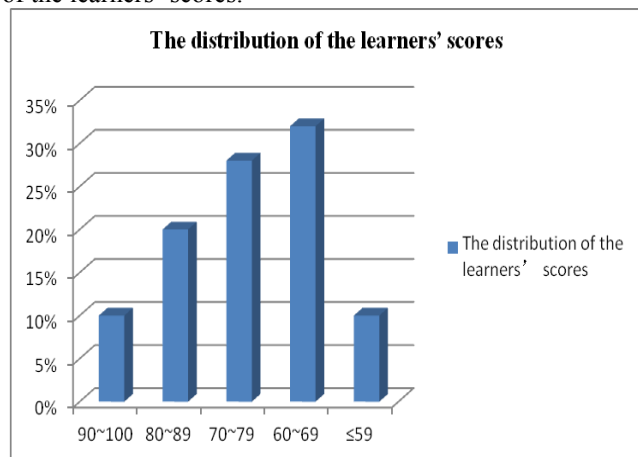


Figure 2. The distribution of the learners' scores.

VI. CONCLUSIONS

This paper promotes the teaching design of microlecture. It should be conducted by the advanced teaching idea. The learning style and mode of instruction is the core. The teaching design mode of microlecture should be considered by the learner-centered, by the characteristics of the learners, by being satisfied with the requirements of the learners. The teaching design mode of microlecture based on the knowledge point of this paper starts from the humanistic theory and constructivist learning theory, and makes them the standpoints. The goal of course opened and shared should be considered on representing the teaching resources and organizing the learning activities. And the styles of them become more and more multiple with the development of ICT. The course structure is based on knowledge point and the length of video for each unit is about 15 minutes. This can adapt to the diverse learning styles, including mobile learning.

The teaching design of microlecture adapted to the characteristics of the learners and satisfied with the requirements of the learners is a challenge task. We had just tried to find the teaching design mode of microlecture based on the knowledge point, and had put it into practice. We should be in depth-study in the future.

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