

# Research of Database Curriculum Construction under the Environment of Massive Open Online Courses

Wang Zhanquan, Yang Zeping, Gu Chunhua, Zhu Fazhi, Guo Weibin

**Abstract**—Recently, Massive Open Online Courses (MOOCs) are becoming the new trend of education. There are many problems under the environment of Database Principle curriculum teaching process in MOOCs, such as teaching ideas and theories which are out of touch with the reality, how to carry out the technical teaching and interactive practice in the MOOCs environment, thus the methods of database course under the environment of MOOCs are proposed. There are three processes to deal with problem solving in the research, which are problems proposed, problems solved, and inductive analysis. The present research includes the design of teaching contents, teaching methods in classroom, flipped classroom teaching mode under the environment of MOOCs, learning flow method and large practice homework. The database designing ability is systematically improved based on the researching methods.

**Keywords**—Problem solving-driven, MOOCs, teaching art, learning flow.

## I. INTRODUCTION

IN 2012, MOOCs were increasingly popular in the universities of the United States, and the famous universities offered a large number of excellent courses for free on network learning platform, and make it possible for more learners learning college courses by themselves. Many universities outside the United States establish the cooperation with Coursera, Udacity, edX which are the MOOCs platforms. MOOCs [1], [2] are defined “a courses of distribution across participants and the courses material is distributed in the network”, and “the courses is open, the larger the better the results”. It connects learners and teachers who are scattered around the world by discussions and exchanges. MOOCs can be considered as a new development in the field of distance education, and also a new development in open education field that is promoted by open education resources. The main features for MOOCs are: 1) tool resource diversity, many social networking tools and various forms of digital resources are collected, and a diversified learning tool and rich curriculum resources are provided. 2) it is easy for the learners to study in the platforms. The limitation of traditional curriculum time and room is overcoming, learner from all over the world can learn domestic and overseas famous college courses at home by using the Internet. 3) The coverage of course is large. The number of learners is unconsidered, but it must be considered in the schedule of traditional curriculum, because MOOCs can

satisfy the large-scale courses. 4) Learning is willing. MOOCs have high school enrollment, at the same time, they also have high dropout rates. This would require that the learner has the strong ability of autonomous learning in order to complete the courses content on time. Main elements include teachers, learners, theme, learning material and background. In China, many universities have set up relevant MOOCs such as Tongji University’s MOOCs VB.NET Program design course, computer basis of National University of Defense Technology, introduction to computer thinking of Harbin institute of technology, and so forth.

Database technology is one of the fastest growing technology in computer science and technology. It is widely used in the computer aided design, artificial intelligence, electronic commerce, field of chemical industry, resources and environment, and so on. It becomes one of the most important topic on the promotion of information technology [3]-[5]. When MOOCs become a new trend at educational circles, the main problem is how to construct database course; there are many questions, for example, there are a lot of gaps between theory, and practice teaching, and how to ensure the quality for the practice part under the environment of MOOCs. Interaction and communication between teachers and learners is not enough under the environment of MOOC [6]; it involves less in the management of large database system server and application, and cannot satisfy the needs of enterprises for talent. So, analyzing the main existing problems are very important in the teaching process. The problems are efficiently solved by researching the following methods, for example, researching of teaching reform, the teaching contents design, the classroom teaching methods, flipped classroom pattern design under the environment of MOOCs, researching and designing based on “learning flow” method, database remote experiment, and the homework practice.

## II. METHODS OF DATABASE PRINCIPLES DESIGN UNDER THE ENVIRONMENT OF MOOCs

The course idea includes the following statement: “database design is the main line, which is aiming at training database design ability”. Some related topics are designed to allow learners to become the main body of learning by more communication. Those topics are database design, mode decomposition, relational algebra, and so on. The teachers lead learners to a series of discussion, and teach them how to design database according to these topics. It was seriously argued according to the teaching contents design, classroom teaching methods, teaching model design under the environment of MOOCs, “learning flow” design method, the construction of

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database remote experiment, practice system construction, and timely adjusted according to the learners to master practical situation during the process of implementing.

*A. The Teaching Contents Design*

The object of teaching for the database curriculum is to improve students' ability of database design based on the computational thinking-driven and ability to solve problems by using database. Computational thinking [7]-[9] as one of the basic mode in the human scientific thinking, and the computer

world at home and abroad pays wide attention to it. Specific knowledge of teaching is timely introduced into computational thinking in the separation of concerns, reduction, insertion, conversion, protection, redundancy, fault-tolerant, error correction and recovery, heuristic, compromise and so many basic concepts and thinking methods. Fig. 1 shows the computational thinking-driven database principle and all kinds of practice teaching, overall carrying out the computational thinking to whole course.

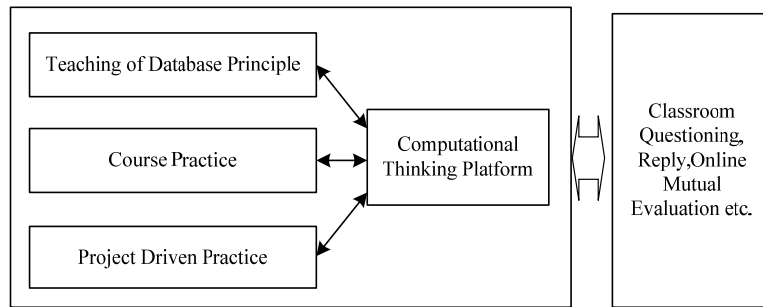


Fig. 1 The computational thinking develops orientation figure in database principle teaching design method

Under the computational thinking-driven, the selection and organization of teaching content under the environment of MOOCs is very important. The emphasis should be on the database design in the application environment [11], [12]. The course should adopt the strategy of “take, don't take”. Combined with characteristics of MOOCs and the learners in our university, in the aspect of design themes, more practical applications are designed. The learners can understand the theory through the application by using less theory and more applications.

*B. The Teaching Time Length Distribution Design Based on Emotional Communication between Teachers and Learners*

In the traditional teaching mode, teacher explains the knowledge in the classroom and is not involved after class, but a lot changes have taken place in this situation, which is more classroom flip and interactive communication under the environment of MOOCs. The learning decision will be from teachers to learners. Thereby, learners and teachers are the main body pattern in teaching modern modes. In this teaching mode, video can be divided into two kinds, self-study and focus video. Focus video is emphasized by teacher and it is important and intensive. In this video, teacher can decorate some questions to ask the learners to do. This part can also be explained in the

classroom to develop the relationship between teachers and learners, because the teachers and learners face-to-face interaction can clearly determine each other's material. There is some great education worker, such as Confucius and Xu Chen and they said that teacher should teach learners in accordance with their aptitude, so face-to-face interaction is the most important way to judge the learners. If there is no such communication, it is difficult for learners to progress. In addition, learners can concentrate more on active and project-based learning by using the above ways, such as database design, E-R figure, mode decomposition and so on. Teachers cannot spend time to teach general information, and the general information will be learnt by learners themselves in a platform where they can see video lectures, listen to the podcast, read e-books, and discuss with other classmates online at any time. Teachers also have more time to communicate with everyone and they can fully excavate the individual potential of learner. In the remote education flip classroom, the time distribution is shown in Fig. 2. In this way of learning, teacher can monitor the situation of learner's self-learning, and reflect the teacher's value in preaching, reassuring, and teaching.

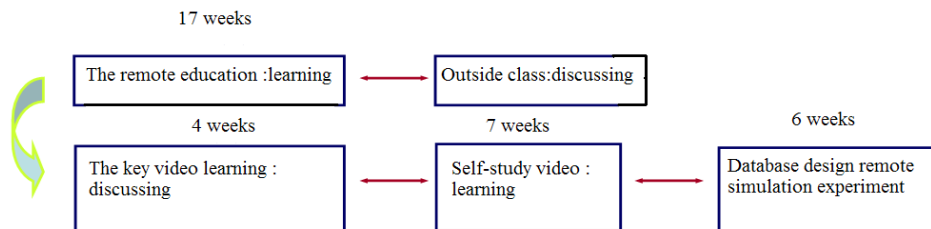


Fig. 2 Flip the classroom teaching mode

### C. Teaching Methods and Techniques (Including Classroom Instruction and Video Teaching)

When teaching database course, they tend to wander under the environment of MOOCs due to the convenient teaching methods, and skills and spoken language is very important in the video.

#### 1. Teaching Methods

Multimedia methods are combined with the traditional methods.

Adopting the way of “giving priority to multimedia teaching, blackboard writing is complementary”, a variety of teaching methods are complemented each other.

Database course is a strong logical course. In order to visualize it, conveniently understand, and use knowledge, teaching by the use of modern multimedia methods is combined with the traditional methods. Multimedia presentation and traditional blackboard writing cooperate with each other, and bring practice into the classroom.

- Programming, debugging and running sample directly under the environment of SQL SERVER 2008, and getting the results.
- In view of the relation algebra theory and mode decomposition, it is glad to write on the blackboard when the logic is difficult to analyze.
- Syllabus, knowledge points, implementation process can use multimedia presentation.

The way of multimedia teaching is informative, intuitive, and able to facilitate dynamic demonstration of the algorithm. However, the content of each page on the screen is limited and updated slowly. Moreover, it is not convenient for learners to compare the former content with the latter. Learners cannot respond to it and keep up with the teacher's ideas. However, traditional blackboard writing just makes up for the defects. This is a practical course. If the traditional teaching courseware, the teaching mode of “a piece of chalk, a class”, is still used, it is far from enough. The method of imaginal thinking is used in the course of teaching. Besides, according to the specific situation, the specific teaching mode is chosen. The computer is used as a tool because learning goals aims at understanding the application of theory. If the single and traditional teaching mode is used, it will be “air-to-air”. If one SQL command on the blackboard is carried out, learners will doubt whether your result is correct constantly. The effect of teaching will be much better if SQL sentences run under the environment of real system.

#### 2. Teaching Skills

It is generally believed that teaching is an art. In order to make the course show powerful charm and let teachers and learners be immersed in the state of art, it is best to strive for the art of every teaching. For the database course, if learners answer the questions according to the book, it is good to say “you read so good”. If a learner practices more in this manner after class, it is believed that he/she will recite it fluently. If a learner cannot answer questions with books, the teacher will say you are lucky because it is believed that you will be called up next time. If he can answer the question successfully without books, it is best to say that he is excellent, and he will be able to an expert in database in the future. In the course of database principle teaching, faced with some learners with rich emotions and personality, the teacher can use personal, flexible, different kinds of evaluation languages to motivate learners' potential. At the same time, we must evaluate ever learner reasonably. Moreover, the theoretical knowledge is so useful that the theoretical knowledge must be spoken out especially. The ultimate goal of studying is pursuing advanced studies. Database design can be used in many areas. All in all, it is clear that appropriate praise, caring criticism, hopeful encourage and ardent expectation can help create a good and pleasant atmosphere.

#### D. The Design Based on Learning Flow under the Environment of MOOCs

To analyze the database learning problems and learner's behavior and characteristics under the environment of MOOCs, the design method of learning flow is proposed under the environment of MOOCs. After the learner scanned the database file, he/she will be registered for the course. When learners master the online video and some class education, the process is as follows: 1) learning course content PPT, short video, replenishing document and so on. 2) simulating exercise-self-test and review, quizzing-discussing-explaining, finishing homework and submitting. In this process, teacher and assistant teacher participate in answering questions and assessing process, and giving learning evaluation. Besides, the self-test practice system of computer training, the self-test question about theoretical knowledge and database question repository are provided for learners, which can guide learners to consolidate the knowledge after class and improve the ability of programming. The preliminary design method based on learning flow is shown in Fig. 3.

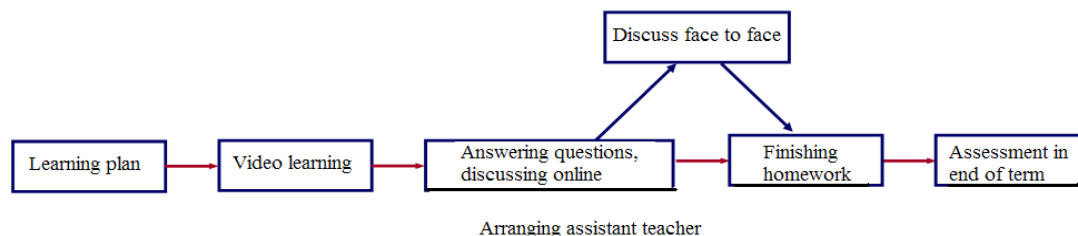


Fig. 3 The design method based on learning flow

### *E. Progressive and Multi-Level Practical Teaching System Construction for the Purpose of Engineering Training*

This is a practical course. By studying this course, learners should not only master database query language itself, but also have the practical design ability. This course is mainly related to the content of subject methodology and design form. Its process is as shown: 1) proposing questions. 2) designing questions. 3) selecting data structure. 4) analyzing the database design process. 5) cultivate learner's ability. Cultivating ability is the core. Practice more is an important way to improve the ability of learners.

The practice teaching content should be designed by the gradual way because it is difficult for some learners to understand the thinking method of course (especially in the first half of the semester). So teachers should adopt cases in the process of video teaching as far as possible. At the same time, the remote experiment is adopted to help the learners deeply understand the thinking method of designing database. The guidance of extracurricular science and technology activities which is combined with big homework and extracurricular practice for learners is strengthened in the course of teaching the database system curriculum. The teachers encourage learners to establish project by themselves, and participate in teacher's research projects. At the same time,

We will strengthen cooperation with some information systems software development companies, such as Oracle, IBM and so on. Moreover, a joint laboratory will be established. Besides, the teaching and training are very good which can shorten the learner's grinding period in software company and information company, and strengthen learner's employment confidence. The big homework is completed on our school's MOOCs platform. During the specific big homework practice, the policy of carrots (praise) and big stick (pressure) must be used. Learners are grouped into two groups to accomplish a big database project homework. The general standard of completion is as follows: 1) there are at least seven tables in the system 2) it will be good if the trigger, procedure and view are used.

In the specific guidance, teachers should check constantly by themselves, and force every learner to finish the project by themselves. Teachers need to check more than five times in the process and master the speed of finishing the project to guide learners better.

### *F. The Remote Database Simulation Experiment*

After the remote database simulation experiment system is analyzed, the remote database simulation experiment system is put forward under the environment of MOOCs, which is divided into three parts specifically:

- 1) Teacher adds the experiment. Every teacher add their own experiment content, specific requirements of courses, the correct answer of experiment, the common errors analysis of experiment, and big homework theme into the system. Teachers can see the subject of the experiment which is submitted and manage the experiment.
- 2) The learners can see the experiment requirements and homework assigned by teacher after logging in system

through the Web browser. The learners complete their homework and submit them. After the system performs database operations, it will return the corresponding results (correct results or error messages). The learners can see the analysis of the experiment and the common reasons of errors in experiment process. At the same time, they can also ask teacher to answer questions for experiment by using the platform etc. Finally, they submit SQL statements as the final result. In the process, teacher will record all kinds of log for learners, and analyze it in the MOOCs environment.

- 3) Teacher monitors experiment and guides learners. The system will record learner's entering and leaving time and what the learners did. Teacher can grasp and check the completion of the experiment for learners, and answer learner's questions and conduct experiment instantly.

### *G. The Design of Teaching Quality Assurance Measures*

Quality assurance and evaluation are very important in the course of learning. Teacher can record learner's online data, for example learning time by large data analysis, number of the clicks. Teachers mark the online scores for every learner by querying the questions put forward by the learner and the degree of active online of the learner. At the same time, teachers can also evaluate the project implementation by learner's homework situation, big homework, remote experiment situation information and online logging etc.

## III. CONCLUSIONS

Through the research and design of this course under the environment of MOOCs, it is clear to help learners master basic database knowledge and improve their ability of designing database. Moreover, it can improve the learners' ability based on project driven of using database knowledge to solving practical problems. Besides, it can help learners design and construct database course teaching system, allocate time reasonably, master the techniques of video teaching, design learning flow and practice system. In addition, it can help learners master database knowledge fleetly, instantly, efficiently and conveniently. Finally, it can help learners have a good foundation for the further study and research.

## ACKNOWLEDGEMENT

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## REFERENCES

- [1] Allen, I Elaine and Jeff Seaman. Going the Distance Online Education in United States(R).Needham, MA: Sloan-C,2011.
- [2] Cormier, Dave. The CCK08 MOOCs-Connectivism course,1/4 way. Dave's Educational Blog.2013.
- [3] Sa Shixuan, Wang Shan. Introduction to Database System (The second edition) (M).Beijing : Higher Education Press,2000:67-97.
- [4] Xu Yingjun. The Teaching Design (M).Beijing: Education Science Press, 2001:34-56.
- [5] Abraham Silberschatz, Yang Dongqing. Translation. Database System Concepts (M).Mechanical Industry Press,2013:212-267.
- [6] Su Danlan. Talking about Teacher's Love—A New Interpretation of The Rosenthal Effect (J).Modern Education Science.2014(14):51-53.

- [7] Li Guojie. Computational Thinking not only Belongs to The Computer Science, <http://scitech.people.com.cn/GB/9745727.html>
- [8] Chen Guoliang, Dong Rongsheng. Computational Thinking and University Computer Basic Education. China University Education (J), 2011:7-11.
- [9] Zhou Yizhen. Computational Thinking (J).Communications of China Computer Society.2007.
- [10] Xu Fu, Wang Chunling, Chen Zhibo. Talking about Database Principle Teaching Idea (J).Computer Education,2012:64-67.
- [11] Li Xiaoming. From PPT to MOOCITT. China University Education (J), 2014 (7)8-10.
- [12] Ma Zhaorui, Li Na, Gan Zheng, Li Xia. Model Reform and Application of Online Course Construction under The MOOC Impact (J), Computer Education, 2014(14):22-25.