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Material Physics & Chemistry Quality Network Curriculum Construction and Teaching Practice

Guan Denggao, Lin Jinghui, Long Jianping, Ye Qiaoming, Li Junfeng, Yang Mei

College of materials and chemistry & chemical engineering, chengdu university of technology, Chengdu, China

Abstract

Based on the construction and teaching practices of school's quality network curriculum of material physics and chemistry in Chengdu University of Technology, a few related hot issues are discussed in this paper. The orientation and characterization of the quality network curriculum are analyzed. And a series of the concrete optimization countermeasures and measures are put forward to improve the curriculum construction and teaching quality, such as teaching aims and demands, curriculum system and structure, teaching methods and means, curriculum management and evaluation, and websites construction and service quality and so on. We point out that the long-time construction, maintenance and service of the excellent quality website play a key role in the quality network curriculum construction and teaching. This has important realistic significance to increase continue the teaching effect and promotes professional cultivation of materials science and engineering.

Index Terms: Network curriculum; quality network curriculum; material physics & chemistry; teaching reform

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1.Introduction

The quality of undergraduate teaching has increased year by year since the Project of Higher Education Quality and Teaching Reform was officially implemented by the Chinese Ministry of Education [1]. In the new process of the reform and development of higher education, the project should be pushed further forward. The personnel training mode reform and quality network curriculum construction and teaching are the most important and difficult part to raise substantially the quality [2]. As one of the hallmarks of university teaching level, high-quality network curricula construction and teaching have an obvious radiation, instructive and exemplary for other courses. Therefore, the quality network curricula construction has become one of key works of many universities recently. Combination of education and network has greatly changed the pattern of traditional education [3]. It is inevitable that quality courses change from the traditional manual mode to the digital network model. The network online education is getting more and more popular [4]. The high-quality

* Corresponding author.

E-mail address: guandenggao@163.com

online education courses play an increasingly important role in the new model. So, the developing and sharing of web-based digital quality network curriculum becomes more and more important.

Material physics & chemistry is one of school's quality network curricula in Chengdu University of Technology, which is also an important basic curriculum for materials science and engineering specialty [5]. In this paper, several hot issues about quality network curriculum construction and teaching practice are discussed based on our teaching reform practices. And a series of the concrete optimization measures and methods are put forward in order to improve the fine course quality of construction and teaching. This has the certain positive sense to improve the quality of the major core course construction and teaching and professional cultivation.

2.Orientation & characteristic of the curriculum

A. Talent-training Objective of the Major

Materials science and engineering major in our school has become one of the characteristic specialties of China's Sichuan province after years of the construction of the specialization and discipline [5]. It is necessary to re-think the specialty's orientation and development in order to adjust to the new professional cultivation pattern based on geonomy characters materials and chemistry & chemical personnel training pattern in the new period. It should be beneficial to cultivate the students' innovation spirit, practice ability and comprehensive quality to satisfy the society demand of specialty and utility under the new circumstances.

The talents training objective of our characteristic specialty is to train more multi-level, high-quality and overall development materials science and engineering professional talents. After four years of university studies, students should master systematically the specialty's knowledge and technology. They should also be able to understand the development tendency of the subject. They can be absolutely up to the jobs such as scientific researching, teaching, technology developing, and production managing and so on. Therefore, it is essential to establish and adopt a homologous curriculum system to improve the quality of the cultivated talents who can meet the requirement of society.

B. Orientation of the Curriculum

The curriculum construction and teaching is an important way to realize the personnel training goal. The high quality of network curriculum construction and teaching of material physics & chemistry should further contribute to realize the cultivating goal of material science and engineering major because it can offer a more open-ended, shared, collaborative, interactive, multi-functional teaching platform.

As one of the compulsory courses, the new curriculum reform of material physics & chemistry has highlighted the practicability and innovation. And it has showed fully time characteristic, diversity and selectivity. Material physics & chemistry quality network curriculum construction and teaching have been based on the demands of society and quality of talent cultivation. In the construction and teaching of the quality courses, our main focus is to train future material professionals who can independently analyze and solve problems. Emphasis is laid on the regularity, mechanism and relationships between composition, structure, technology and performance of materials. In a word, material physics & chemistry quality network curriculum can give prominence to characteristics of material major and incarnate modern educational theory and method and meet the requirement of the society for material professional talents.

C. Characteristic of the Curriculum

The quality network curriculum is a reflection of guiding principle, training models, characteristic and educational quality of a school. The applications of the curriculum mode to materials professional education can make students feel the fascination of fine-designed courses. This has contributed to improve the educational quality because it has effectively stimulated student's study interest and fostered the students' creative ability. The quality network curriculum has the following characteristics.

Supported by the characteristic specialties construction project of China's Sichuan province (No.2008-422) and material physics & chemistry school's quality curriculum construction project and based on geonomy characters materials and chemistry & chemical personnel training pattern school's teaching reform project of Chengdu University of Technology.

- The curriculum has well been designed, arranged and organized by our professional teachers with the rich teaching practical experiences under the guidance of the talents training objective and the curriculum syllabus.
- The forefront and the new cross-subject knowledge closely related to the course have been added into the curriculum teaching in time.
- The curriculum contents have been divided into different course modules, and each has a specific teaching goal and the teaching duty request respectively.
- The concrete scheme and implementation measures have been put forward though optimizing curriculum teaching contents, and teaching methods and means in order to satisfy the specialized cultivation demands.

3. Measures and methods

D. Renovation of Teaching Aims & Demands

The curriculum syllabus is of great importance in the construction and teaching as a teaching programmatic guiding document. Before working out a new syllabus, we have spent a long time doing lots of investigations and research work due to the following reasons.

- The great changes of employment situation in recent years have taken place. The demands of employers are always rising with social development and progress. It is more and more difficult for college graduates to find jobs.
- The number of university students is increasing constantly, but the quality of students tends to fall with the higher education popularization.
- Large classes and reduced teaching time are becoming more widely available in universities. A small part of majors is facing many difficulties in vague orientation, unclear features, messy course installation, and comparative poor competency in hunting job and so on.
- The quality of higher education becomes the focus of society along with the enrollment extension of universities.

Therefore, the outdated syllabus of material physics & chemistry have been completely overhauled and reformed. The out-of-date knowledge has been removed and some new knowledge, aims and demands have been introduced in the new syllabus according to the change of actual situation. And the education of versatility and creativity should be valued in training high-quality material professional talents for the 21 century. This has helped to alleviate the contradiction between supply and demand of material professional talents. So, the renovation of teaching aims and demands has been treated as a key of the curriculum construction and teaching reform.

E. Optimization of Curriculum System & Structure

The optimization of the curriculum system and structure has been one of the focuses of the curriculum construction and teaching reform. Module teaching is an advanced teaching method. Recently, quite a few universities have promoted the reform of module teaching. In our curriculum construction and teaching practice process, the existing curriculum system has been broken, and the teaching resources and processes have been integrated and optimized based on the training of students' core special ability. Through many years of practices, the system and structure of the curriculum of material physics & chemistry have been optimized and subdivided into the four modules by us in Table 1.

TABLE I. THE CURRICULUM SYSTEM AND STRUCTURE

Module Number	The Curriculum System and Structure	
	Module Name	Module Contents
module1	Relationship among component, structure, preparation process and performance of materials	Component, structure, preparation process and performance and application of typical crystal, amorphous, colloid materials
module2	Analysis of phase equilibrium & phase diagram	Unitary phase diagrams, binary phase diagrams and ternary phase diagrams
module3	Materials kinematics	Theory and application of materials kinematics of solid phase change, diffusion and sinter at high temperatures
module4	New materials and technologies	Theory and application of new materials such as new energy materials, nano materials, and electronic information materials

It can clearly be seen that the system and structure of the curriculum is a unified whole, but each module has a respective specific teaching content and goal request from table 1.

- Module 1 is to enable students to understand from many aspects that the variety and complexity of materials.
- Module 2 is for students to get a better understanding that different thermodynamics conditions such as composition, pressure, and temperature have important effects on the microstructures and organizations of materials.
- Module 3 is to let students to understand the diffusion, solid state reaction, and sinter are correlated with material manufacturing processes and material structures and properties.
- Module 4 is to make students to know the current status and progress of new materials.

F. Innovative Teaching Methods & Means

Scientific, proper teaching methods and means are the key to improve the teaching quality. In the course of teaching of material physics & chemistry, different methods and means should be adopted according to the different educational contents, process and objects.

1) *Integrate Teaching Models*: Teacher's sound, language, expression, writing on the blackboard, model, wall map, material object and so on are playing a key role in the traditional teaching model. The model has both rationality and limitations to some extent. With the rapid development of modern education skill, the appearance of multimedia online education offers the opportunity for setting up new-type teaching mode. As one of important measures of modern education reform, the network-based multimedia teaching has already been implemented largely in teaching. The student-centered teaching system design is one of the major requirements in the new teaching mode. And it can give full play to multimedia technology in teaching and arouse students themselves motivation, initiative and potential to study. This can greatly improve the quality of curriculum teaching and learning. Certainly, some problems still exist in the mode. Teachers should take the advantage of multimedia teaching and discard its disadvantage to improve teaching quality. So, we have adopted a composite mode of teaching and learning through the integration of new teaching technology of network multimedia, traditional teaching means and teaching method, and class discussions. The new multiple teaching models have made great achievements in our teaching and learning practice. The quality network curriculum construction has been conducive to the university students to study the curriculum at any time and

anywhere. This has improved their enthusiasm, initiative, efficiency and conveniences to study the curriculum. And this has improved the teaching interesting, education quality and education satisfaction degree.

2) *Grasp Core Content and Issue*: In the university, material physics & chemistry is an important basic course. But it is generally considered as the more abstract and difficult courses to understand and study because of its theoretical and professional practicality. We have used a unique step by step approach to grasp core content and issue of the course with straightway words and methods such as from shallow to deep, from simple to complex, and from phenomenon to essence. The emphasis and difficulty in teaching is one of the main tasks. Moreover, we make these knowledge as more visualize and lifelikeness and understandability as possible by means of comprehensive applications of modern and traditional teaching methods and means. For example, when we have introduced mainly the current technologies of ceramic sintering by three-dimension animation, the sintering kinetics of the ceramics and the main factors affecting sintering have been handy discussed analyzed, summarized and reviewed. What the students need is not only to acquire both the knowledge and technology, but also to accumulate the process, experience and method of study. This contributes for students to grasp the ideas and views so that they will be able to use freely and flexibly their knowledge in their posts to solve the actual problems. This may be the soul for the undergraduate teaching.

3) *Cultivate Comprehensive Quality*: At present, university students' extra-curriculum activities in science and technology are colorful and varied. More students take an active part in these activities. The typical problems of materials science and engineering in the practice out of class have been discussed promptly in detail in the classroom teaching or on the high-quality curriculum website of material physics & chemistry. The success communication and interaction could help students develop independent thinking and problem-solving customs and abilities. These also contribute for students to deepen understanding and grasp of the course knowledge and cultivate their specialized qualities and comprehensive qualities. In other words, this is an essential process of training the creative, combined and high-quality talents of materials science and engineering, which students can learn to solve the problem of uncertainty by using flexibility the knowledge of certainty.

G. *Perfection of Curriculum Management & Evaluation*

The curriculum management & evaluation is an arduous work in school, because it involves many factors. We should construct the course managing system, perfect course managing measures, and strengthen the administration of the teaching process in order to improve the quality of the undergraduate education.

1) *Construction of Courses Managing System*: The curriculum management & evaluation is an integrated system involving student's achievement management, teacher's management and course management. The construction of courses managing system in material physics & chemistry quality network curriculum should be designed for teachers to make statistic, supervise students' studying, and communicate with students and long-distance control and so on. For example, the thorough syllabus, which can clearly explained teaching goals, content and grading policy, should provide for students at the beginning of this semester on the course website.

2) *Perfection of Courses Managing Measures*: Courses managing measures can be taken into perfect by many ways. For example, the mature syllabus, teaching instruction, online teaching, question answering, and feedback system should be well-designed and strictly enforced according to the characteristics and requirement of the curriculum.

3) *Implement of Courses Comprehensive Evaluation*: In the process of teaching, examination often acts as an important tool of the evaluation of teaching and teaching feedback effect in the traditional teaching model. But the evaluation of learning process is not much accounted. So, the implement of new comprehensive examination and evaluation of the course is quite necessary. For example, we regard the after-class reading as the beneficial extension and complement of the curriculum learning and comprehensive evaluation. We should instruct students to develop the habit of independently seeking relevant non-class reading or internet material to magnify the up shots of learning. At last, every student must write and submit a relative reading note. The final

scores of this course are decided by means of synthesis of three scores including efficiency of classes, quality of schoolwork and final exam.

H. Improvement of Websites Construction & Service Quality:

The interactive curriculum learning website is a teaching resource network-based multimedia teaching environment. In material physics & chemistry quality network curriculum construction, one of the important tasks is to establish the high-quality curriculum website. Based on our experience, some principles, contents and cautions of website construction and service are put forward.

1) *Principles of Website Construction & Service:* The website of the curriculum should become a new window and convenient, efficient, open and web-based multimedia teaching platform. The functions of curriculum developing, course management and students learning are integrated. In classroom teaching, individual learning or distance education, the platform is depended on and the learning effects are affected by the quality of the teaching platform. So, it's very important to improve the websites construction and service quality.

2) *Contents of Website Construction & Service:* All the course resources including multimedia network courseware, electronic teaching materials, handouts, home works, and solutions should be available on the course website. The website system should include teaching interface, management system and forum and so on. The system with friendly interface is very reasonable, practical, and convenient. For teaching interface, multimedia courseware which is one of the important teaching resources should have a good interface besides sound, images, video and cartoons. The teaching interface can also expediently improve instruction methods and enrich instruction contents. Teachers can execute teaching management through management system including teaching module, student managing module and auxiliary function module. The forum platform, which is learning exchange system, can combine conveniently teachers and students to exchange their feelings and experiences of teaching and learning. Therefore, they are obliged to make the best of network teaching interface, resources, and services in practice.

3) *Cautions of Website Construction & Service:* The improvement of the curriculum websites construction and service quality will be a long-standing and formidable process, neither accomplished overnight, nor guaranteed once and for all. So, this general objective must be divided into short-term goals, and finished step by step. We should investigate the students at regular intervals and find the shortage of our work and improve it. The application of new technologies will let the curriculum website more attractive. A long-time excellent quality website maintenance and service plays simultaneously a key role in the quality network curriculum construction and teaching.

4. Conclusions

According to our practices of the construction and teaching of material physics and chemistry school's quality network curriculum in Chengdu University of Technology, some concrete optimization countermeasures and measures in order to improve the curriculum construction and teaching quality are analyzed and introduced in this paper. These measures basically include renovation of teaching aims and demands, optimization of curriculum system and structure, innovative teaching methods and means, perfection of curriculum management and evaluation, and improvement of websites construction and service quality. It is provided with some reference values to further research to increase continue the teaching effect and promotes professional cultivation of materials science and engineering.

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