

Discussion and analysis on the excellent course and its website construction of “Materials Testing Technology”

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Abstract—An excellent course construction plays an important role in improving the teaching quality and promoting the teaching reform, and while a course website construction provides a good medium for the teaching. The excellent course construction of “Materials Testing Technology” of Shandong Jianzhu University, which draws lessons from the practical experience of other colleges and universities, and combines with the resources of themselves and the advantages of development, has made great progress in the teaching staff, teaching methods and contents, teaching management and the construction of the practice bases. The website construction is an important link in the process of the excellent course construction. A variety of methods rich the course website is adopted. It has provided a powerful platform and a good supporting for the teaching.

Keywords—materials testing technology; excellent course; teaching reform; website construction

I. INTRODUCTION

The evolution of materials guides the social progress, and those are based on the rapid development of high-tech industries. Materials with information technology, biological technology are considered to be the most important and potential for the three pillar industries in 21st Century. All countries will vigorously develop new materials as the acting point to improve the core competitiveness of the national economy [1]. The modern material science states the relationship between a composition, microstructure and performances of the materials. If the macro structures of the materials are only characterized, it is difficult to deepen the cognition and expand its scope of application. However, from the micro perspective, we can in-depth study many unknown phenomena, and build the bridge of material design, manufacturing process, and obtain the satisfactory performance. Therefore, the testing technology of materials is a key link of this bridge [1,2]. “Materials Testing Technology” course is about the principles, experimental methods and its applications of several kinds of analysis and testing technology used in the materials science researches, such as X-ray diffraction(XRD), transmission electron microscopy(TEM), and scanning electron microscopy (SEM), and so on. Thus, the learners should have the ability of testing and analysis on surface morphology, composition, the organizational structure of a given materials. Hence, this course has a very important position in the development of materials science and engineering and the training of related talents.

The excellent course construction in institutions of higher education is an important part of teaching quality and teaching reform project. The excellent course sets scientificity, advancement, educational, integrality and demonstration as a whole. Meanwhile, it embodies the thought of modern education teaching, and accords with the rule of modern science and technology, and meets the need of social development and progress. Furthermore, the excellent course also can provide more excellent teaching content and more perfect system of teaching service for learners. This is beneficial to promote the development of higher education teaching reform [3]. The website of the excellent course undertakes an important task, which shows many teaching contents, teaching methods and network resources of the course. It is a “window” about the demonstration and the radiation effect of the excellent course, and has played a very active role in the excellent course construction [4,5]. In recent years, Shandong Jianzhu University attaches great importance to the development of the excellent course construction. By taking the advantage of their own development, a lot of the province-level and school-level excellent courses, such as “Fundamentals of Materials Science”, “Materials Testing Technology” and “Non Destructive Testing” and so on, have been carried out and constructed on the basis of existing mature experience. The rich experiences of theory and practice, which include the teams, contents, methods, means in teaching and teaching materials, experiments, the mechanism of teaching management, website construction, have been accumulated. We have made the materiality effects and progresses.

II. THE CONSTRUCTION OF “MATERIALS TESTING TECHNOLOGY” EXCELLENT COURSE

A. Course overview of “Materials Testing Technology”

As a basis and forerunner of the development of high and new technology, the materials analysis and testing technology has increasingly been high technicalization and modernization along with the changes of the times, and playing more and more important role. “Material Testing Technology” is the backbone course of materials science and engineering profession. This course mainly lectures the principles, methods and applications of modern materials analysis and testing, which is the necessary means for studying the material composition, structure and performance [6,7]. “Material Testing Technology” course of Shandong Jianzhu University is a major compulsory course offered according to undergraduate training plan of our country, and combining with the advantage majors and key development direction of the school. The course contents of teaching include: the principle of X-ray diffraction and electron diffraction, electron optical basis, kinematics base of diffraction contrast, the basic principle and general structure of modern equipments (XRD, Electron Microscope). We focus on the basic methods of analysis for material structure, crystal defect, composition and morphology of micro area. Therefore, the testing methods are supported for students in academic research, and lay a foundation for students to learn other modern instruments.

B. Teaching research of “Materials Testing Technology” excellent course

The researches of “Materials Testing Technology” excellent course in teaching have the following several aspects as:

1) *Teaching team*: Teachers are the founder and implementers of the excellent courses, and also are the key of the excellent courses construction. The knowledge level, teaching ability, innovation consciousness and morality view of teachers can directly decide the quality and development direction of excellent course construction. Our teacher team is mainly composed of the loving education career, high scientific attainments and rich teaching experience. At the same time, they are able to pay equal attention to theory and practice, and give consideration to teaching and scientific research. Teachers can not only play a leading role in the teaching idea, teaching research and teaching effect, but also have the strong enterprising spirit, vigorous thirst for knowledge and unique creativity. The students are inspired, infected and driven to carry on the creative learning and researches. To their own rich practical experience, teachers cultivate students to have keen, smooth, flexible, open innovation consciousness and innovation ability. We should put forth effort to cultivate young teachers for forming a reasonably structured teaching team. By means of encouraging young teachers to further their studies, participating in the project of teaching reform, viewing teaching of famous teacher and holding the young teachers teaching competition and other activities, we lay the groundwork for young teachers to improve the quality of teaching and the ability of scientific research, and to promote their teaching ability and teaching level.

2) *Teaching contents and methods*: The document about the excellent course construction is issued by Ministry of Education. It said that teaching contents of the excellent course are a core of the excellent course construction. This must exhibit the progressiveness, and should timely reflect the latest scientific and technological achievements in the field of this subject. Meanwhile, the advanced teaching experience should be widely absorbed from all aspects. The outstanding achievements of educational reform are actively integrated. And the development of society, politics, economy, science and technology in the new period must be reflected for new requirements of personnel training [1]. Therefore, we combine with the teaching goal and requirements, professional characteristics, the knowledge structure and level condition of the students of the material discipline in Shandong Jianzhu University for building a relatively perfect system of the curriculum content and the knowledge structure of students. “Material Testing Technology” has a lot of course contents and concepts, and has a high requirement for the base of mathematics and physics, and involves more testing methods. But all kinds of testing equipments are seldom relevance, the contents of many chapters are relatively independent and differ in thousands ways of analysis principle. It makes the teaching content abstract and difficult to understand, students learn it to feel dull and difficult. To meet the needs of the course, different chapters are integrated in order and achieve clear, focused. This is advantageous to the teaching process smoothly. The course content is divided into two part of X-ray diffraction (XRD), electron micro-analysis (EMA). The integration of teaching content is shown in Figure 1. Through such teaching process, it can make the course teaching to be more visualization and popularization, and let the student to link the contents of different chapters and to have more distinct and thorough understanding of the important knowledge. Thus, this reduces the burden of students, and makes learning easier and interesting. In the teaching process, we should pay attention to teach students in accordance with their aptitude, use the teaching form (e.g., intuition, heuristics, discussion-based, participatory, case, etc.) which students are vivid, rich and willing to accept, and inspire the students’ learning interest and enthusiasm. Using the advantages of multimedia teaching and course website, the students have a more comprehensive and intuitive understanding and cognition of all kinds of technology. The experimental week allows students to consolidate the basic theory, and meanwhile enhance the ability of testing equipment used and data analysis.

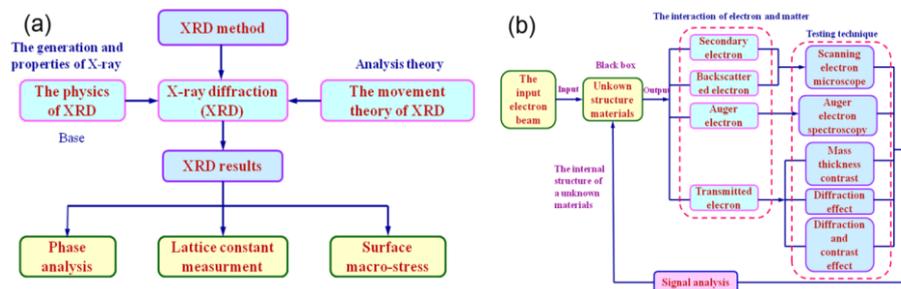


Fig. 1. Teaching contents of XRD (a) and electronic micro-analysis (b)

3) *Teaching management*: A perfect and integrated teaching management system is the basic guarantee for the excellent course construction. According to the actual situation of schools and colleges, we formulate the relevant management system to make the excellent courses construction clear division of labor, have different duties and coordination from all aspects of guidance, inspection and evaluation to the technical support. The special funds of the excellent course construction are established, and the corresponding mechanism of incentive and evaluation is set up. These will support and reward the contributed staff to improve teachers' teaching enthusiasm and the sense of participation. At the same time, the course group focuses on the development and use of modern educational technology, and purchases or exploits the network teaching system of the course and a dedicated website, which combine with the course structure, content, resources and implementation. Such practices give students a broader space for learning and a multidimensional learning way. This necessarily improves the overall quality promoting of the excellent course construction. In addition, we also use the scientific advantage of the teacher team of the excellent course, and lay the full role of a tutorial system of the undergraduates. To further strengthen the mutual impetus between the teaching and scientific research, the innovative spirit of teachers will inspire the innovation consciousness of students so that students directly participate in the process of scientific research, and practice and explore the unknown world with their tutors.

4) *Building the practical teaching base*: The practice teaching base provides the places of experiment, practice and the opportunities of participating in social and economic activities for students. It consolidates the theoretical knowledge of students, practices in the real conditions, and improves the ability of finding, analyzing and solving problems, and stimulates students' creative consciousness. School of Materials Science and Engineering of Shandong Jianzhu University has a provincial-level and a school-level experimental teaching demonstration center, and the materials science and engineering specialty is a provincial-level characteristics professional and a key construction professional of applied talents cultivation of a famous school. With field emission scanning electron microscopy, X-ray diffraction, atomic force microscopy and other large precision instruments and complete furnish the professional experimental equipment, we built a research and innovation base of Shandong province undergraduate education. Those meet the basic needs of practical teaching. In addition, the school provided many policy supports and financial aids for the excellent course construction, and created all kinds of innovation and entrepreneurship fund. It offers a research work opportunities for students, the practice ability and creative thinking ability get a further exercise.

III. WEBSITE CONSTRUCTION OF "MATERIALS TESTING TECHNOLOGY" EXCELLENT COURSE

In order to build the national excellent course with features, such as "first-class teacher teams, first-class teaching contents, first-class teaching methods, first-class teaching resources, first-class teaching management", each school has invested a lot of vigor and enthusiasms, and strived to form the national excellent course construction system oriented three-level from national to province and school, which based on school-level one and guided by national-level one [8]. In a process of "Material Testing Technology" excellent course construction of Shandong Jianzhu University, our teaching group has gradually formed the reasonable title structure, age structure, educational structure, academic structure, education-related structure and extensive discipline. This realized the course's sustainable development and improved the students' innovation consciousness. The members of the course group were conscientious and responsible, meanwhile combined theory with practice and tried hard to study the teaching content in the teaching process. The emphasis of the excellent course construction should be the construction of the network course platform. Through the rich and colorful network course platform, we assisted students to learn, expand their horizons, make up the lack of classroom teaching, and help students accept the better, faster, more comprehensive knowledge. If the excellent course website only acted as an online assessment, it wasted a lot of manpower, material resources and seriously affects the function display of teaching resources, reducing the actual utilization of site resources. How to solve the problem of the "heavy construction" and the "light application"? How to use the internet and multimedia technology for realizing optimal configuration and sharing in using of high quality course resource?

(1) The construction of the excellent course website should have a sense of social responsibility and a spirit of selfless, and the necessity of the social spread of quality education resources and their significance must be taken into account. This can promote the establishment of a good, great social benefit site and make students become the real beneficiaries of the excellent course construction [9].

(2) The members of the course group try hard to use modern information technology, especially focus on the use of network for course teaching and management, and actively prepare for the establishment and improvement the excellent course website.

Teachers are uploaded the elaborate course resource of “Materials Testing Technology” (such as network multimedia courseware, teaching videos, speaking lesson and so on) to the website, and realize the sharing of high quality teaching resources, shown in Figure 2. Teachers can carry on the preparing lessons and the corresponding teaching activities online. In this way, the arcane principle and application of various kinds of testing techniques are given in the form of animation, video and so on, which makes the website content multitudinousness, high flexible, easy to understand and operate. The website is independently designed, built, maintained and updated by the course group teachers, who can timely, quickly and accurately upload and update the related course data, such as course exercises, teaching syllabus, experiment instructor, etc.. In addition, the course website also opened a network answering function. The authorization teachers answer the questions from the students at any time online. So this should not only increase an opportunity for interaction between students and teachers, but also answer questions and disabuse for students in time. The modules of the individual network space of teachers and students, the internal e-mail, the network working group and the electronic white board and so on are set up. The knowledge which have no time to introduce in the classroom can be timely supplements to the student and develop the scope of student knowledge [10]. At the same time, there are many functions of the evaluation managements of exercise homework and the tracking of students' online learning activities. We can tail after without delay and know the application of website resources, and statistics to access information and contents. According to the survey feedback opinion, we can timely and effectively adjust the website form and update the website content, improve teaching efficiency and effect of network. Making use of the excellent course website, it can make organic combination the course construction with the classroom teaching, and give a fully hand for the students' independent and efficient study. This takes effect on mutual promotion and common development [11].



Fig. 2. Web page of “Material Testing Technology” excellent course

(3) In view of “Materials Testing Technology” to the high requirements of experimental skills, the experimental content provided by the course cannot meet the actual application. The existing conditions of the laboratory do not allow students to hands-on operate. After understanding the needs of students, we have recorded the actual testing process of some large equipment with the corresponding explanation, and put on the website for students downloading. In this way, students can not only enhance the understanding of the course content and the grasping of the knowledge, but also increase the practical skills and the knowing of the application.

(4) We have used the time in class and after class to actively propagandize the site and to increase the popularity of the site. This will make that the relevant personnel and students have more opportunities to understand and concern the site.

SUMMARY

In the excellent course construction of colleges and universities, we should be based on the innovative country construction and undergraduate teaching “quality project” as the center, actively establish incentive and restrictive mechanisms, reasonably deploy manpower, material and financial resources, and use modern educational technology, build the active platform of the teaching and practice, and form the sharing platform of the network teaching resources. In the process of “Material Testing Technology” excellent course construction of Shandong Jianzhu University, improving the students’ innovation ability and practice ability is as the fundament, we start from the construction of teaching team, teaching contents and methods, teaching management and practice base, and while assist by the construction of the course teaching website, form a relatively complete teaching system and rich teaching contents. By making full use of the achievements and effects of the excellent course construction, it has the extremely important influence on improving the overall level of teaching, strengthening students’ innovation ability and comprehensive quality, cultivating a comprehensive, high-quality, high level students for social needs.

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