2014

ISSN : 0974 - 7435 Volume 10 Issue 9

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(9), 2014 [3996-4000]

Exploration and practice in the education model reform of the course "Design of the Coal Preparation Plant"

Li Zhen[*,1,2], Yang Chao[1]

[1]School of Chemistry and Chemical Engineering, Xi' An University of Science and Technology, No.58 Yanta Road, Xi' an, (CHINA)

[2]Key Laboratory of Coal Resources Exploration and Comprehensive Utilization, Ministry of Land and Resources, No.4 Jiandong Street, Xi' an, (CHINA)

ABSTRACT

To improve the quality and enhance the ability of students as mineral processing professionals, especially given the current ineffective teaching methods for the course of "Design of the Coal Preparation Plant", an education reform model that emphasizes the development of students' technological innovation and engineering practice ability is proposed in this paper. This model consists of the creation of an open learning environment, which is the basis, the training of students' engineering design capability, which is the breakthrough, and the integration of theoretical teaching with production practice, which is the core. Furthermore, the authors have striven to provide some new ideas for full-featured teaching styles of universities and colleges, and for the development and improvement of the innovative training model.

KEYWORDS

Design of the coal preparation plant; Education model; Reform.

INTRODUCTION

Innovative education is an important component of education reform for universities and colleges, and its ultimate goal is to develop students' comprehensive quality and innovative ability. As typical application-oriented engineering professionals, students in the mineral processing major generally lack practical experience and ability, which undoubtedly influences their employment success. "Design of the Coal Preparation Plant" is a required and major course for students in the mineral processing major, and its main content includes coal quality data analysis, the understanding of the performance of basic devices, and the combination of different aspects of system processes; this content is in response to market demand and should lead to the achievement of the maximum economic and social benefits. Therefore, this course plays an important role in teaching students in the mineral processing major design capability and professional quality. This paper proposes that the creation of an open learning environment is the basis, the training of students' engineering design capability is the breakthrough, and a combination of teaching and practice is the core of this model. Furthermore, this paper strives to provide a new education reform model that aims to enhance the technological innovation and engineering practice ability of students in the mineral processing major.

THE CREATION OF AN OPEN LEARNING ENVIRONMENT

Open learning is an innovative movement in education that first requires the establishment of a study framework based on the learning objectives. Subsequently teachers guide students around this framework and give them opportunities to learn independently and autonomously. As a result, the learning process does not deviate from the syllabus, but students would not be completely confined to the classroom in a passive study mode. The core of open learning is to cultivate students' innovative spirit and practical ability, or, in other words, to actively guide students to perceive, to explore, and to continuously inspire their learning ability. In recent years, with the rapid development of the coal preparation industry, the key point of coal processing is about the optimization of plant configuration and the resolving of bottlenecks that were experienced by traditional techniques. Therefore, professors who teach the course "Design of the Coal Preparation Plant" in the authors' university need to keep pace with changes in the frontier of technology and remain creative. As for the education reform, it should guide students by using a combination of the main multimedia methods and networking resources.

The full utilization of the advantage of multimedia teaching

The course "Design of the Coal Preparation Plant" is known for a huge amount of data and information, involving interactive factors and complicated inherent patterns. Therefore, the priority of this course is to figure out the coal quality of a specific coal plant. Since mathematical methods are often required during the analysis process of coal quality (e.g., a dynamic analysis of coal production and related products), it is difficult for students to fully grasp the relevant data analysis methods in the classroom within a limited time frame. Moreover, it is unrealistic to expect them to apply their knowledge in practice. Therefore, the relevant professors in the authors' university point out that the key is to set up an open learning environment, so that students can learn better and put their knowledge into practice effectively. Specifically, the key points of coal quality analysis are shown through multimedia courseware, and the whole calculation process is displayed in a classroom presentation format. Through this approach, it is not only easier for students to grasp the mathematical methods of coal quality analysis, but is also helpful for them to better understand the design ideas involved, and be well prepared for their postgraduate design projects.

The rational use of a network system to extend extra-curricular teaching activities

With the rapid development of information technology, the issue of how to perfectly integrate education with network technology has become a priority in educational studies. However, several problems are likely to arise with rich network resources. For instance, since the amount of information is huge, many students admit that it is really difficult to find the information that they actually need. Therefore, professors need to filter out relevant information related to the curriculum and recommend

meaningful content to the students. For the teaching course of "Design of the Coal Preparation Plant", professors in the authors' university have striven to discover websites and databases that are related to the coal preparation plant. Also, the following work still needs to be done for the purposes of teaching reform: ①Professors need to become familiar with the coal technology network, coal preparation equipment network, coal preparation databases and other resources. They should then classify useful information and provide the lists to students. Students can further investigate the information that interests them the most according to their needs; ②Professors need to become familiar with computer-aided software related to the coal preparation technology, such as mineral processing CAD, data processing software Origin, and coal preparation process calculation software packages, and outline the advantages and disadvantages of such software to students. During the early learning phases, they should encourage students to draw diagrams and do calculations by hand. During the later learning phases, they should encourage students to become familiar with the software industry in order to improve their work efficiency; ③Professors should communicate with students using network-party tools, such as Tencent QQ, Email, Fetion and other software, in order to keep track of their progress. Also, professors could summarize their own experience, exchange innovation ideas, and share useful information with their students on a regular basis. As a form of feedback, students could communicate and interact with their professors informally once they have developed some good ideas.

Regular displays and reports of the design process

To design a coal preparation plant, open mindedness is generally considered an important attribute. Moreover, it is necessary to consider questions such as whether the process is reasonable and whether the device is suitable from the multi-faceted and multi-angle perspectives. Therefore, if the design process simply relies on the available design blueprint, a lot of technical problems are to be expected in the later phases of the design. During the teaching course, professors in the authors' university have realized that many students have difficulties in data analysis regarding coal quality analysis. Furthermore, these students tend to refer to the blueprint, but have no ideas about the process of the related project design. It is no surprise that the graduation project designs of these students are similar or identical, resulting in a bit of a sham. In order to guide students who take the course "Design of the Coal Preparation Plant" to better understand coal mineral information, professors in the mineral processing field have asked students to make regular displays and presentations about their design projects at different stages. Moreover, in addition to group discussions and directional communications, professors and students are welcome to express their opinions. Through this new approach, the students' ability to explain their design ideas is enhanced. Furthermore, an open learning environment is successfully established so that communications and interactions between professors and students become more easily facilitated.

THE DEVELOPMENT OF THE STUDENTS' ENGINEERING DESIGN CAPABILITY

A top priority of higher engineering education is to develop students' engineering design capability. With comprehensive in-depth reforms in various universities and colleges, the development of students' engineering design capability is bound to get noticed, appreciated and promoted. In terms of the practical aspects of the development of students' engineering design capability in the author's university, the process of curriculum design receives a lot of attention, and the openness of such a design is also emphasized, as reflected in the improvement of teaching methods, the development of students' engineering cognition, and different types of assessment strategies being applied.

The improvement of teaching methods

The training of students with regard to engineering concepts, engineering cognition, and the ability to analyze and solve engineering problems is the main purpose of engineering design courses, and the training quality will reflect the extent that students understand and master the relevant theoretical knowledge. The traditional teaching model might help students to deal with a variety of tests, but it is difficult for students to understand and solve practical engineering problems independently. In

addition, since “Design of the Coal Preparation Plant” is an application-oriented course, it requires students to be good at solving practical problems. Professors in the author’s university have striven to explore how to improve the open teaching methods so that students can not only master the basic design concepts and methods, but also be encouraged to identify and solve problems, and draw conclusions all by themselves. Specifically, the following reform work has been done: ①when professors introduce mathematical methods related to coal quality analysis to students, they first make sure that the students understand the purpose of the upcoming computing process, and then introduce the basic calculation procedures and methods once they are familiar with national standards; ②professors carry out periodic comprehensive training practice, and guide students to draw important conclusions by themselves during the design process so that such information can be memorized efficiently; ③professors prepare questions for students in the classroom, making the class well-organized and highly efficient.

The development of the students' engineering cognition

Since the field of mineral processing engineering is highly practice-oriented, the development of students' engineering cognition is important in engineering practice. However, ordinary universities and colleges often lack education funds and laboratory equipment. Moreover, the training practice tends to ignore the development of students' engineering capabilities. In recent years, several professors from the authors’ university have realized that the most efficient way of developing students' engineering cognition is to strengthen the comprehensive aspects of the design experiment; this is based on their careful analysis of the design characteristics of the coal preparation plant and the various exploration and practices that are being conducted. On the basis that experimental teaching hours are ensured, laboratories are opened in a systematic manner in order to improve the experimental open rate. On one hand, the equipment utilization rate is increased, and students have more hands-on opportunities; on the other hand, the enthusiasm of professors and students participating in the teaching practice is enhanced. Meanwhile, investment in additional equipment and training has been increased, in particular investment in the construction and expansion of laboratory facilities has been doubled, and support for students' innovative experiments and experimental competitions has been enhanced, which all serve the purpose of cultivating talented engineers with strong capabilities with regard to scientific and technological innovation. Only through the constant development of students’ engineering cognition and engineering design capabilities, can they become familiar with the design process of coal preparation plants and relevant equipment selection operations.

Diverse types of assessment strategies

An effective way to cultivate students' engineering design capability is to set up appropriate assessment methods. Currently, the teaching assessment criteria in many universities and colleges are too one-dimensional, with written test scores as the sole measurement of the students’ mastery of specialized knowledge. As a result, many students only pass the exam by rote memorization and last-minute study, which not only suppresses students’ enthusiasm for study and their learning activities, but also produces students who find it is difficult to meet employment requirements. “Design of the Coal Preparation Plant” is a course that is highly practice oriented, and professors in the authors’ university have developed some fairly balanced performance assessment methods and criteria through professional discussion and practice, or, in other words, they have striven to establish diverse types of assessment strategies that combine aspects of qualitative and quantitative assessment. Firstly, in terms of assessment methods, students are required to master critical design processes and calculation formulae. Moreover, they are required to use coal preparation national standards and relevant charts properly. Secondly, in terms of the assessment criteria, the assessment of teaching courses is more detailed, including the analysis of original data, calculation steps of flow charts, mass balance processing, equipment selection procedures, and assessment of CAD drawing effects. In addition, in terms of performance assessment, a student's final grade consists of regular grades, test scores and design work grades of certain percentages. Overall, such an assessment approach not only considers students’ design capabilities, but also takes into account students’ regular performance, such as attendance rate, and cooperation ability.

THE INTEGRATION OF THEORETICAL TEACHING WITH PRODUCTION PRACTICE

Production practice is an efficient way for students in the mineral processing major to consolidate their professional knowledge and skills. The production practice of the mineral processing major is arranged in the early semester of the course "Design of the Coal Preparation Plant". The purpose of such an arrangement is to help students to integrate their professional skills with design practice. However, after several years of teaching practice, it has been noticed that during the process of production practice, students tend to behave like visitors and do not engage in any meaningful way. Therefore, the effect of such production practice is reduced, and it is often difficult to meet initial learning objectives. In order to achieve a perfect integration of theoretical teaching with production practice, so that students can design an optimal coal preparation plant, it is necessary to reform this production practice according to the course requirements of "Design of the Coal Preparation Plant".

Firstly, on the basis of the reality of industry production and professional knowledge, professional professors should prepare a detailed professional practice program or guide book according to the requirements of the production practice. Moreover, professors who teach the course "Design of the Coal Preparation Plant" should point out the learning content students should have mastered in advance before the production practice starts. Secondly, during the production practice, professors who lead the practice should be able to answer questions from students in a timely manner, and help students understand the connection between theoretical knowledge and actual problems. Through this integration of theoretical teaching and production practice, the students' learning interest should be motivated, and the knowledge obtained from the classroom can be consolidated. Thus students could learn more about practical situations, and be better prepared for their job and life-time career.

CONCLUSION

As an important curriculum that helps the development of the engineering quality and professional skills of students in the mineral processing major, the education reform of the course "Design of the Coal Preparation Plant" is worthy of attention from professional teaching teams. In the authors' university, professional professors have striven to explore the education reform of the course "Design of the Coal Preparation Plant", which is bound to provide some new ideas for full-featured teaching styles of universities and colleges, and promote the development and improvement of an innovative training model.

ACKNOWLEDGEMENTS

The authors are grateful for the Provincial Natural Science Foundation Research Project of Shaanxi (No.2013JQ7017), the Scientific Research Program Funded by Shaanxi Provincial Education Department (No.14JK1460), the Fund of Key Laboratory of Coal Resources Exploration and Comprehensive Utilization, Ministry of Land and Resources (No.KF2013-3) and the Higher Education Research Project (general project) of Xi'an University of Science and Technology (GJY-2013-YB-1).

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