The Innovation Experiment Teaching Practice of Mineral Processing Engineering Major Based on the Excellent Engineering Talents Training

Jie SHA*, Guang-yuan XIE, Yao-li PENG and Wen-cheng XIA

Key Laboratory of Coal Processing and Efficient Utilization (Ministry of Education), School of Chemical Engineering and Technology, China University of Mining and Technology, Xuzhou 221116, Jiangsu, China

*Corresponding author

Keywords: Mineral processing, Innovation experiment, Practical ability, Excellent engineer.

Abstract. The specialty of mineral processing engineering of China University of Mining and Technology attaches great importance to the cultivation of practical ability of undergraduates, and has invested a great deal of manpower and material resources to ensure the construction of conditions for the cultivation of innovative ability. The innovation of mineral processing experiment is a professional scientific innovation experimental course after the end of the courses. The students' practical ability and innovative thinking further strengthen, through the practice of teaching reform of mineral processing innovation experiment course.

Introduction of Mineral Processing Engineering Major in CUMT

Mineral Processing Engineering is one of the earliest majors in CUMT that are qualified to grant a master's and a doctor's degree and it has a post-doctoral research center. It was rated as the National Key Disciplines in 2002 and 2007. It is the first batch of disciplines in Ministry of Education which are provided with the Cheung Kong Scholars Award Scheme Chair Professors. It joined the National Characteristic Specialty Construction Project in 2007. The main course teaching team of Mineral Processing Engineering Major was named as the national teaching team in 2008. It joined the innovation group of National Natural Science Foundation in 2009, and gained the second rolling support in 2013. In 2009, the mining engineering discipline where mineral processing engineering belongs was selected for the Priority Academic Program Development of Jiangsu Higher Education Institutions, and gained the second rolling support in 2014. Mineral Processing Engineering is a key discipline of 211 Project and 985 Project Innovation Platform, and is characterized with the processing and utilization of coal resources and clean coal technology. Currently, a number of international leading level research results have been achieved. Mineral Processing Major in CUMT has become an important teaching and research base and has high academic status and influence in the world. At present, the comprehensive strength of Mineral Processing Engineering in CUMT is ranked first in Jiangsu province and also in the whole country [1].

The Construction of Conditions for Innovation Ability

In order to improve the teaching quality of undergraduate students and strengthen the cultivation of students' scientific research innovation ability, Mineral Processing Engineering Major relies on the National Engineering Research Center of Coal Preparation and Purification, Key Laboratory of Coal Preparation and Efficient and Clean Utilization of the Ministry of Education, and Engineering and Technique Center for Clean Coal and Ecological Recovery of Mines of State Environmental Protection Administration. The major also makes full use of key discipline of 211 Project, 985 Project Innovation Platform and Superior Discipline Platform in Jiangsu Province to provide teaching and experiment conditions for students.

The laboratory has an area of 6800 m2. The number of instruments and equipment which are worth more than 800 yuan is 1914. The total equipment asset value is 33.26 million yuan. The number of
large precision instrument and equipment which is worth more than 100 thousands yuan is 65 and the total asset value is 20.87 million. Figure 1 shows the pilot scale and industrial scale testing systems such as air dense medium fluidized bed for dry coal preparation pilot scale system, dry sieving pilot scale system, heavy medium cyclone separation pilot scale system, cascade flotation column pilot scale system, jigging separation pilot scale system, electronic waste utilization pilot scale system and triboelectrostatic beneficiation pilot scale system. These systems have the characteristics of perfect function, flexible process parameters, high level of automation and strong operability. These systems also play an important role in teaching, experiment, graduation project and internship [2].

![Figure 1. The pilot scale and industrial scale testing systems.](image)

**The Innovation Experiment Teaching Practice of Mineral Processing Engineering Major**

At present, the Mineral Processing Engineering major is carrying out the training program for excellent engineers. After finishing the basic course, students are selected to form classes for excellent engineer training.

Small classes, tutorial system, setting up innovation fund, joint guidance by school and enterprise and strengthening engineering practice are adopted in the program. The aim is to cultivate high level innovative engineering talents who know about the latest developments of mineral processing, and have social adaptation ability, engineering practical ability, organization and leadership skills, innovation ability, international competition ability, solid knowledge, the ability to adapt to the site environment and the school environment and enterprising and humanistic spirit [3,4].

Mineral Processing Engineering major achieves the goal of improving students' innovation ability through the experimental teaching, internship teaching, special test, science and technology training plan, tutorial system and the combination of producing, studying and research. In the experimental teaching practice, the traditional curriculum model which regards the experiment as a part of the theoretical curriculum is broken and replaced by some of the experiments being set up as lessons alone. These experiment lessons include mineral processing engineering training, metalworking, electrical and electronic technology experiment. The fundamental, practical, comprehensive and systematic of the experimental contents are highlighted. The depth and breadth of the experiment teaching are expanded by innovation experiments which are combined with teachers' scientific research projects and advanced scientific research methods. In the innovation experiments of Mineral Processing Engineering, students can choose the experiment direction they are interested in and prepare the experiment by themselves. In this way, students' research ability and innovation ability are strengthened.

The mineral processing innovation experiment course is set up in the 7th semester of the undergraduate course, which is after all the main courses. The course is based on the mineral
processing experiment research methods and teachers' research projects. Students are divided into groups consisted of 6-12 people and each group is guided by a relevant teacher.

In order to cultivate students' innovative thinking and problem solving ability, the supervisor will put forward a subject for each group. The experiment research process is consisted of the following several parts.

Consulting Related References and Specifying the Research Background and Significance

A week of time is usually arranged for students to consult related references. Students can know about the latest research process, research background, the value of the research and the research methods and technics through literature review.

Making Plans and Designing the Experiment

It is very important to make a good design before doing the experiment. After knowing the experiment purpose, students are supposed to make detailed designs for each part of the experiment. These parts include the preparation of test samples, property analysis of test samples, selection of the operating conditions and operating parameters, experiments under different operating conditions and parameters, laboratory analysis of the separating/screening products, selection of evaluation indices, prediction of the test results and possible problems may arise in the experiment, etc. The group members should discuss with the supervisor several times before the experiment plans are determined, and after that, they can enter the next step of the experiment.

Dividing the Work and Carrying out the Experiment

The experiment is supposed to carry out in an orderly manner on the basis of a well-designed experiment plan. The experiment should be under the guidance of the supervisor and the arrangement of the group leader and each group member should work on their part of the experiment. In order to make every step reasonable, panel discussions are needed for solving the key problems (such as the selection of the operating conditions) arising in the experiment process.

Analyzing and Reporting the Experimental Results

After the experiment, students are supposed to process and analyze the experiment data, and then complete the experiment report under the guidance of the supervisor. Each group needs to give an oral defense for their experimental results and the results are graded by a panel of supervisors. Combined with the performance during the experiment process, each group member's final score is given.

Summarizing the Results and Enhancing Innovation Ability

Students are encouraged to write papers and try to contribute to high level journals. In this process, students are able to learn paper writing skills as well as paper submission skills and enhance their innovation skills comprehensively.

After the training in mineral processing innovation experiment course, students can not only consolidate the knowledge they have learned, but also improve their problem discovering skill, problem solving skill and innovative thinking skill.

Conclusion

Mineral Processing Engineering major in CUMT constantly attaches great importance to the teaching practice. The excellent engineer training program takes a variety of measures to improve students' practical and innovation ability. Mineral processing innovation experiment is a course which combines the professional knowledge with research frontiers. At present, Mineral Processing Engineering major is still increasing the fund for teaching conditions and making efforts to improve the combination of practical teaching and the frontiers of the discipline, aiming at cultivating students with innovation and practical abilities.
Acknowledgements

This work was financially supported by the research project of higher education reform in Jiangsu Province (2015JSJG065) and education and teaching reform project of China University of Mining and Technology (2017YB17). We also thank the first phase project of Jiangsu brand professional construction project and the priority academic program development of Jiangsu higher education.

References


