

Measures to improve undergraduate graduation design in a coal and coalbed methane major

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ABSTRACT: Undergraduate graduation design (a final year student project or thesis at Chinese universities) is an important part of undergraduate education. The quality of it has declined with the development of mass higher education in China. The characteristics of undergraduate graduation design in a coal and coalbed methane engineering major are summarised in this article, and the problems and deficiencies are identified and discussed. These include problems with graduation practice, topic selection for graduation design, research, mid-term supervision and thesis writing. Measures to improve graduation design are summarised and include improving the management of the graduation design and thesis quality.

INTRODUCTION

The general office of the Ministry of Education of China identifies undergraduate graduation design as important in realising a training target [1-2].

In the context of Chinese tertiary education, *graduation design* is a term that refers to a final year student project or thesis at Chinese universities, sometimes *graduation project* or *graduation thesis* is used. Whereas *graduation practice* is a term that refers to a final year Chinese student's activities in support of the graduation design, it could be an internship or some sort of work in an enterprise.

Additionally, undergraduate graduation design has an important role in training college students for scientific research, and developing their practical abilities. Furthermore, by focusing on real outcomes, it promotes students' innovative ability and entrepreneurship [3-5]. At the same time, the quality of the undergraduate graduation design is an important basis for evaluating student learning and awarding diplomas [6-7].

Undergraduate graduation design combines learning, practice, exploration and innovation. It cultivates the quality of students' engineering practice and draws deeply on students' knowledge. As such, the undergraduate graduation design reflects the education quality at colleges and universities. The undergraduate graduation design significantly influences a student's work style, work attitude and capacity for independent work [8].

UNDERGRADUATE GRADUATION DESIGN FOR A COAL AND COALBED METHANE ENGINEERING MAJOR

A coal and coalbed methane engineering major was introduced recently into Chinese higher education. It results from the demand for professionals in the field of coal mine gas control and the development and application of coalbed methane (CBM) in China.

The major has rich theory and requires students to be practical and innovative. With the implementation of the national energy policy, particularly the governance for coal mines, and the commercialisation of CBM, more graduates in the major are needed. Students in the major even have signed contracts with employers in the senior year, before graduation

The number of graduates is far below the demand of enterprises and institutions [9-10]. The characteristics of undergraduate graduation design of the coal and coalbed methane engineering major are as follow:

Wide Topic Range

There are many undergraduate courses related to coal and coalbed methane engineering. These include drilling and completion engineering, coalbed methane mining, mine gas extraction, coal mining, mine ventilation and safety, coalbed gas geology, mine geology and gas geology. After graduation, students not only can be engaged in the exploration and development of CBM on the ground, but also can work on the control of coal mine gas. Therefore, the major covers a wide range of core courses, including mining engineering, safety engineering, geological and geophysical exploration. The topic selection of undergraduate graduation design of coal and coalbed methane engineering in the past three years are shown in Figure 1.

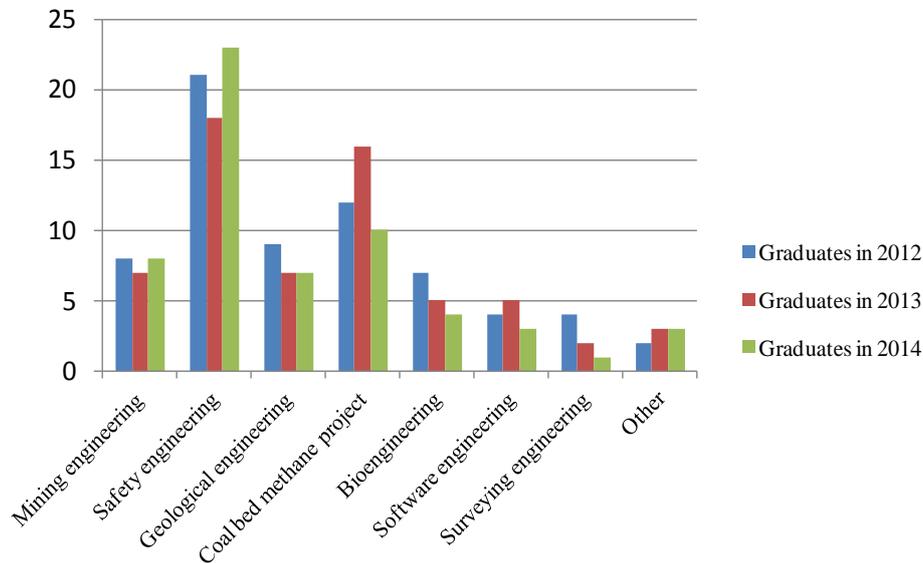


Figure 1: Topic selection for undergraduate graduation design.

Close Association with Practice

Coal and coalbed methane is an engineering-focused major, and most of the graduates work as professionals in coal mine production or exploration, and development companies for CBM. Undergraduate teaching is very important as it prepares students for their technical posts after graduation.

Good quality teaching combines theory with practice and cultivates students' abilities to identify and solve problems. Undergraduate graduation design integrates the student's knowledge with practice and problem-solving. Therefore, students take the opportunity at graduation design to choose topics that are closely related to problems in actual production processes. Excellent students may find and solve challenging problems in practical applications in industry.

Cross-linkage of Courses

The coal and coalbed methane major involves various interdisciplinary courses. Students should not only know about safety underground mining, but also have knowledge of CBM exploration and development above ground; they should be capable of reading mechanical drawings, guiding civil construction, measuring and exploring.

In summary, to understand the occurrence, migration, and production of coal seam gas and apply the knowledge in practice, students have to master roadway development and preparation, equipment selection, construction, surveying and mapping as the above courses are interlinked and supplement each other.

PROBLEMS IN UNDERGRADUATE GRADUATION DESIGN

Inappropriate and Poor Topic Selection

Statistical analysis for graduates who have majored in coal and coalbed methane engineering at Henan Polytechnic University in 2012-2014 has revealed that graduates mainly found employment in three areas, as shown in Figure 2, which gives the number of graduates.

First, 26.5% or 50 of the 189 graduates pursued advanced education; second, 23.8% of the graduates selected CBM development companies to explore and develop CBM on the ground; third, 41.8% of the graduates were engaged in gas extraction and safety management in underground coal mining. The remaining 7.9% were self-employed or pursued some other category of work.

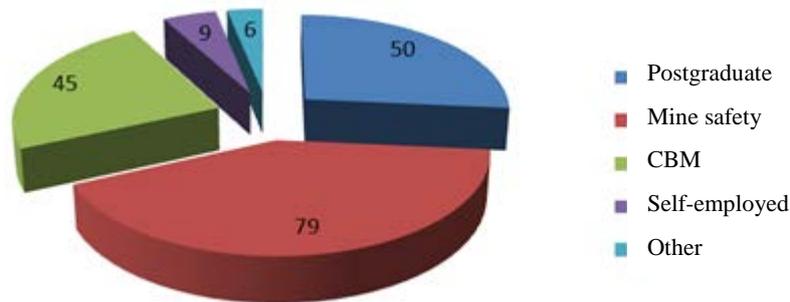


Figure 2: Selected topics.

Most students had determined their employment intentions before graduation. But, in the topic selection, students often choose easy topics and academic advisors do not demur. A small number of students even consider that the topic selection is not important and pay little attention to it. They do not correlate the undergraduate graduation design with their future work.

Lack of Evaluation of Graduation Practice

Graduation practice, as an indispensable link to undergraduate graduation design, provides material and support for the undergraduate graduation design and combines theory with practice. But owing to the depression in the mining industry in recent years, employers are not willing to accept student internships, particularly, in underground coal mines because of safety concerns.

Even if the employers admit students into a mine, the students do not necessarily have the opportunity to learn underground. In addition, only a small proportion of students have the opportunity of practice in an enterprise organised by teachers. Some students do not want practice in the field owing to fear of rejection and, perhaps immature attitude towards work as such. Although schools selectively examine students' graduation practice, it is not properly evaluated.

Paying More Attention to the Design Result while Ignoring the Design Process

Undergraduate graduation design is the culmination of a student's undergraduate education lasting four years. But teachers and students pay more attention to the thesis design itself, while ignoring the process of topic selection, design proposal, and mid-term inspection and assessment. However, the process usually determines students' learning and technical skills. Paying more attention to the process can prevent students rushing to include material to get high scores in design.

MEASURES FOR IMPROVING UNDERGRADUATE GRADUATION DESIGN

Better Control by Teachers and Clear Responsibilities

Teachers are responsible for directing the whole process of students' independent undergraduate graduation design. Teachers guide students concerning topic selection, structure, format and writing, as well as evaluating the thesis and thesis presentation by the students. The guidance should focus on the correct understanding and application of basic concepts and theories, analytical ability, testing, calculation and compilation, writing skills, and foreign language reading skills. Teachers are supposed to guide students, taking account of differing abilities. According to these differences teachers should provide tailored guidance on topic selection, content requirements and Chinese and foreign reference material.

Furthermore, teachers must encourage innovation and guide students in investigation and analysis. Teachers should train students to apply theory in practice, pointing out that students should respect others' work and cite the literature for the results of previous research.

Selection of the Topic of Graduation Practice

Graduation practice is carried out by students in an outside organisation (e.g. research institute, production enterprise) prior to undergraduate graduation design and after three and a half years of higher education. Graduation practice enables students to learn the basic methods for scientific research and engineering design. Therefore, it is an important link in developing practical, research and innovative ability.

Graduation practice reinforces theory and enables students to explore and learn the current situation in the development of coal and coalbed methane industry and production processes. Teachers should guide students on choosing challenging topics, which can guide their future work taking account of their personal interests and the nature of the contracted work.

Process-oriented Focus on Graduation Design

Undergraduate graduation design develops a student's ability for analysis and problem-solving using theoretical knowledge and basic skills. To be specific, it requires students to systematically arrange and analyse data, draw diagrams, and to analyse and solve problems related to the exploration and development of coal and CBM. The students put forward opinions based on field investigations, testing, analysis and data collection. Therefore, the issue is not just the product of the graduation design, but the whole process of producing the product of the graduation design. Meanwhile, teachers should be stricter in the supervision of students' graduation practice and the process of graduation design.

CONCLUSIONS

Undergraduate graduation design, the last component of undergraduate education, is the culmination of four years of university education. The characteristics of undergraduate graduation design in a coal and coalbed engineering major were analysed to reveal deficiencies and to suggest measures by which to improve the quality of undergraduate graduation design. These measures include a more rigorous attitude by teachers, with clearly defined responsibilities. This requires good management so as to secure a timely outcome.

More attention should be paid to the process of the graduation design and better teacher guidance should be provided by which to inspect and evaluate the undergraduate graduation design.

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