

Teaching Reform of “Mine Ventilation and Safety” Based on Modular “Smart Classroom” Construction

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Abstract: “Mine Ventilation and Safety” is a fundamental course for safety engineering students. However, the current teaching mode has several shortcomings, including low student motivation, an irrational teaching mode, inefficient teacher-student interaction, and unreasonable process assessment. These issues fail to meet the requirements of the information age for undergraduate engineering education objectives. The course “Mine Ventilation and Safety” will be reformed based on the development of the Internet and the widespread application of information technology. The basic knowledge of the course will be reorganized, and the teaching content will be reconstructed. The implementation of a network information platform to create a “smart classroom” can enhance students' learning initiative, improve teacher-student interaction efficiency, and enhance students' ability to solve practical problems. This can lead to the cultivation of high-quality, professional, and skilled individuals.

Keywords: Mine Ventilation and Safety; Teaching Mode; Curriculum Reform; Smart Classroom; Information Technology.

1. Introduction

Mine ventilation is a crucial technical means to ensure safe underground mining. It plays a vital role in the coal mining process. For students of safety engineering and mining engineering, learning about Mine Ventilation and Safety is essential. This course mainly covers the basic knowledge of mine air composition, mine air flow characteristics and determination, mine ventilation methods, and mine ventilation systems. Mastering the principles and methods of mine ventilation provides a strong basis for working in related fields.

The course “Mine Ventilation and Safety” is highly professional and practical. Previously, the course was taught mainly through classroom lectures and laboratory operations, covering the knowledge system outlined in the textbook syllabus. However, due to the students' lack of relevant professional knowledge and practical experience, they found it difficult to accurately grasp and understand the relevant knowledge and principles. This teaching mode also failed to effectively combine the teacher's practical experience with actual teaching, which hindered the development of students' ability to solve real-world problems in the mining industry. In the context of national innovation-driven development, there are higher requirements for students of new engineering majors due to major development strategies such as 'Internet +'. With the continuous updating and improvement of information technology, the traditional teaching mode is no longer sufficient to meet the teaching needs. At present, the extensive reach of virtual networks offers a range of intelligent learning methods that can facilitate online education. The development of Internet technology has provided a new opportunity for curriculum teaching mode and method reform.

Currently, we are in the era of intelligent education, and technological changes are affecting students' thinking and learning. The question of how to effectively utilise students' creative and practical abilities in classroom teaching deserves profound reflection in today's classroom reforms. The blended teaching mode, which combines traditional teaching methods with information technology, has promoted surface

learning among students at the primary cognitive level. However, deep learning for the advanced cognitive level needs further strengthening. The smart classroom utilises new-generation information technology, such as big data, cloud computing, and mobile internet, to provide technical support for the teaching process. This enables data-based teaching decision-making, instantaneous evaluation feedback, three-dimensional communication and interaction, intelligent resource pushing. In this paper, in order to improve the initiative of undergraduates' learning under the traditional mode of teaching, we adopt intelligent teaching tools such as "Rain Classroom" and "Learning Channel" to carry out the "five-step teaching method" modular teaching reform, which is oriented towards the output of students' practical and innovative ability, and to cultivate the comprehensive ability of students to solve practical engineering problems.

2. Key Issues Facing the Current Curriculum Model

The rapid development of network information has rendered the traditional teaching mode inadequate for meeting the demands of the new era in cultivating professional talents. This will enable the development of a new teaching mode that meets the requirements of the times. To foster high-level talents with innovative practical abilities, it is necessary to analyse the specific problems that exist in the current education mode and identify the key factors that affect the quality of students.

2.1. Students are not Motivated to Learn

Previously, students have understood the employment situation of this profession through various ways, and they are confused about their career development prospects. Due to the lack of relevant practical experience and knowledge base, there is a certain degree of difficulty in the learning of professional knowledge, which in turn produces an aversion to learning. The boring teaching methods make students instinctively resist and frustrate students' enthusiasm. Negative attitudes towards learning can cause students to adopt an inter-professional and inter-industry mentality,

leading to a lack of focus on professional course knowledge. This can result in a weak theoretical foundation, making it difficult for students to complete practical operations within the given timeframe, ultimately hindering the development of innovation and entrepreneurship.

2.2. Unreasonable Teaching Method

The course “Mine Ventilation and Safety” traditionally employs a lecture-based teaching approach, with an emphasis on theory and a lack of practical experience. This results in a deficiency of relevant experimental conditions, professional ventilation simulation environments, and teaching of actual underground ventilation tests. As a result, students without field experience may struggle to accurately grasp the professional basic knowledge, and there is a significant disconnect between theory and practice. Presently, multimedia teaching is a necessary tool for teachers to conduct classes. However, there are discrepancies in the actual classroom results. Many teachers simply copy the textbook content, and the tedious course material hinders students' learning initiative. “Mine Ventilation and Safety”, as a course that combines theory and practice, requires a combination of theoretical explanations and practical operations. It also requires the integration of multi-modal teaching to achieve optimal results.

2.3. Ineffective Teaching Interactions

Effective teaching interactions can enhance the effectiveness of teaching and learning. Many teachers prioritize classroom interactions to improve teaching and learning effectiveness. However, achieving effective interaction can be challenging. In the teaching of “Mine

Ventilation and Safety”, due to limited class time and a large number of students, teachers may not have sufficient time to interact with students and assess their understanding of the subject matter. This can make it challenging to ensure that all key points and difficult concepts are adequately covered within the curriculum. Limited to the teacher-student relationship, students may be hesitant to ask questions, resulting in decreased participation and dull, unengaging lessons. This lack of interaction between students and teachers can lead to inefficiency in the classroom and hinder the development of student leadership.

2.4. Lack of a Rational Process Appraisal Mechanism

The assessment and evaluation system for the curriculum can reflect the effectiveness of the reform, and demonstrate the professional abilities and overall quality of students. In the past, course assessment was primarily based on final examination results and other quantitative measures such as attendance, homework, classroom performance, and laboratory reports. Table 1 illustrates the traditional approach to course assessment. The final examination is open-book, which may lead students to neglect regular review and rely solely on last-minute cramming. This can result in a lack of flexibility in mastering professional knowledge. Attendance is taken through roll call, which not only takes up valuable classroom time but also creates resistance among students. Plagiarism is common in homework and laboratory reports, making it difficult to assess the authenticity of students' work and their level of knowledge mastery. As a result, the effectiveness of teaching control is not always clear.

Table 1. Quantitative indicators for course assessment and evaluation

Evaluation projects	Proportion to total score	Evaluation Note
Learning attitude	15%	Random questions, access to online resources, sign-up rates for online platforms
Classroom performance	15%	Homework, discussions, answering questions, personal reflections, summaries of issues
Experimental Report	20%	Completion of the report, reflection on the issues, and application of knowledge
Final Test	50%	The improvement of knowledge points, the application of knowledge, the ability to analyse problems, and the grasp of exam content
Total	100%	Process appraisal+ final Test

3. Teaching Reform Model for the Curriculum based on “Smart Classrooms”

In the context of “Internet +”, educational activities have become more diverse. It is important to fully utilise the resource advantages of “Internet +” and accelerate the development of a smart classroom model that meets the needs of the new era. The development of information technology has led to the use of intelligent learning platforms for teaching tasks. This enhances the relevance of student learning, improves their motivation, and reflects their main position in the teaching process.

3.1. Optimising Teaching Content in the Context of Information Technology

Starting with the cultivation of high-quality management

talents, we have sorted and studied the obsolete knowledge system and teaching contents with reference to the work of mine ventilation quality standardisation. The course “Mine Ventilation and Safety” will be divided into four units: mine wind measurement, mine ventilation resistance determination and evaluation, mine air distribution and air regulation, and ventilation system optimization. These units will be structured according to the degree of difficulty of the knowledge points, progressing from shallow to deep and from easy to difficult. The teaching module is constructed as shown in Figure 1. To do different knowledge points targeted to develop different teaching methods, so that knowledge points with the times.

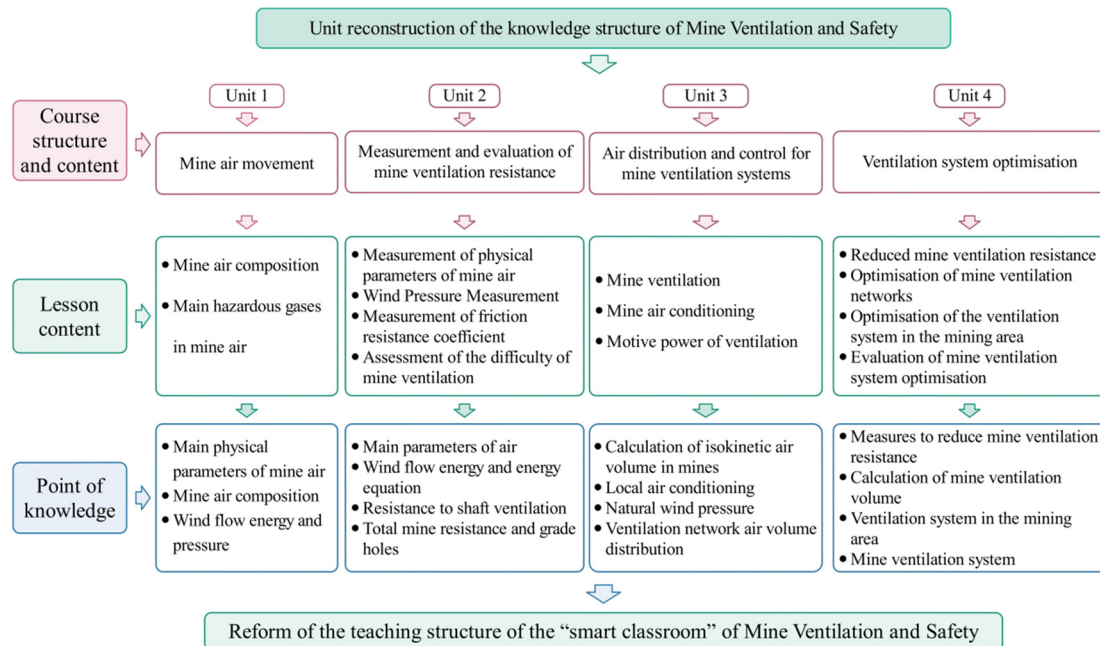


Figure 1. Reconstruction of the knowledge structure of the programme

3.2. Reform of the "Smart Classroom" Teaching

"Smart Classroom" is a fundamental element of undergraduate smart education. Its purpose is to integrate information technology and education to enhance students' enthusiasm for learning the course of "Mine Ventilation and Safety" through classroom teaching. Video learning materials on underground engineering can be shared with students in a timely manner, facilitating their understanding of the practical application of professional knowledge in the environment.

This is made possible by the simplicity of big data and the Internet, combined with the characteristics of the "smart classroom". The research focuses on the teaching of the teacher and the learning of the students. The "smart classroom" five-step teaching model is used, combined with the key steps of each section, to design the general teaching process of each section in detail. Figure 2 illustrates how the teaching link is constructed in the context of information technology. It address the shortcomings of the original multimedia teaching and emphasise the significance of wisdom education in the teaching and training process.

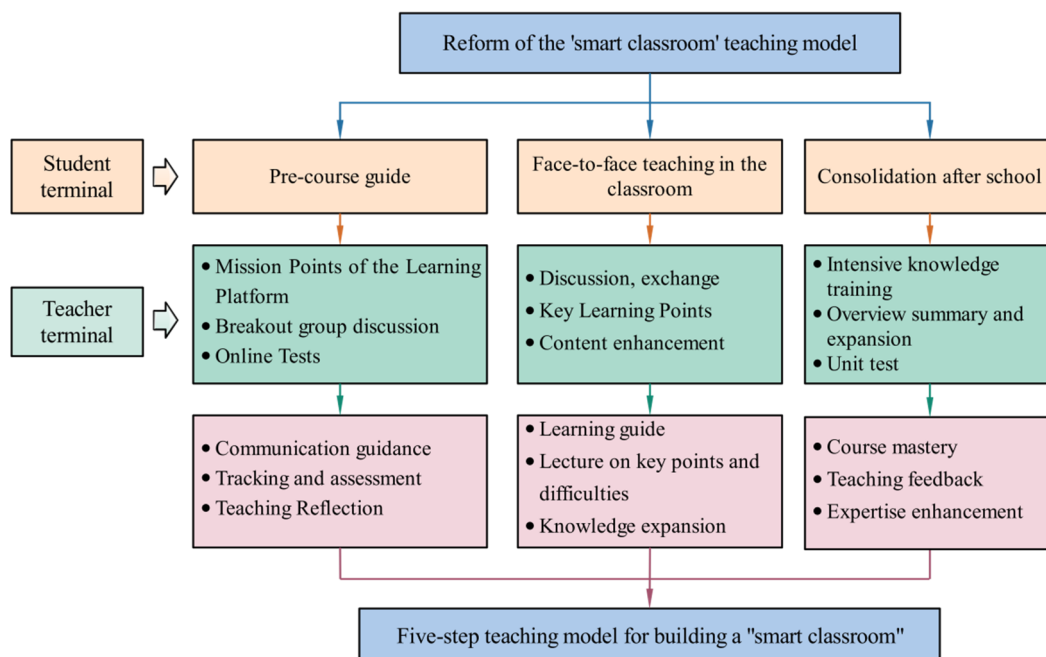


Figure 2. Schematic diagram of teaching link

3.3. A Five-step Teaching Model for Creating a "Smart Classroom"

In the context of the "Internet +" era, the traditional

teaching mode has been unable to meet the requirements of undergraduate education in engineering colleges and universities. To address this, a five-step teaching mode of "test a test", "say a say", "tell a talk", "do a do", "think a think"

is employed, with lecture chapters as the unit. The content of each chapter's teaching is designed and optimised individually. The course PPT courseware has been improved to achieve modularity in the "smart classroom" teaching mode. Teachers can use the school's network teaching platform to release learning series and tasks to students, and supervise their learning progress. This allows for better understanding of students' learning situations and the formulation of targeted teaching guidance programmes based on online learning tracks and feedback. This enables them to develop targeted teaching guidance programmes. A virtual experimental platform can simulate the operation process of mine ventilation, cultivating students' interest in active participation and improving their practical abilities.

3.4. Integration of Online Resources for the "Smart Classroom"

The integration of information technology resources in education has led to the development of "smart classroom", which are considered a crucial aspect of education reform. Smart classrooms combine learning activities, communication, and information technology to provide teachers with an intelligent teaching platform and students with a comprehensive smart learning platform. Online resource platforms such as MOOC, Learning Channel, Rain Classroom, and Mining Classroom have been perfected and are now effectively used in the teaching process, embodying the characteristic of student-centered teaching. Online teaching methods such as Dingding, Tencent Conference, and Enterprise WeChat can be used to teach tasks at any time, without restrictions on class time or location. This allows for a greater extent of problem-solving in teaching and timely monitoring of student learning status. The hybrid teaching mode, which combines online and offline methods, promotes better learning extensibility and enhances students' independent learning abilities.

3.5. Feasibility of the "Smart Classroom" Five-step Teaching Model

In the era of information technology, major network platforms have risen, and educational apps have been developed to provide convenience. Nowadays, students are equipped with various communication tools such as mobile phones, computers, and iPads, which enable them to receive network information, communicate in a timely manner, and access text, audio, video, and other resources to ensure the timeliness of teaching. New teaching tools and technologies based on information make abstract knowledge more intuitive and graphic. This greatly mobilises student participation, strengthens their understanding, and improves the efficiency and quality of learning. Information technology also promotes students' analysis of professional knowledge and helps them achieve higher-order goals such as independent thinking, creativity, and understanding.

4. Conclusion

In the era of rapidly advancing information technology and big data on the internet, the educational informationization plays a crucial role in establishing a modern education powerhouse. The development and implementation of "smart classroom" is a key strategy for promoting computerisation in

education. Creating a "smart classroom" in colleges can integrate learning activities and information technology, reflecting a "student-centred" teaching philosophy. By analysing the data on the educational network platform, we can gain a clear grasp of students' learning status, and to a certain extent. We have solved the problems of insufficient teacher-student interaction, lack of feedback and evaluation, and students' passive status, and promoted the diversified development of teaching. In conclusion, the use of "smart classroom" technology for "Mine Ventilation and Safety" can enhance students' learning enthusiasm, improve their professional cognitive abilities, and contribute to the cultivation of high-level, capable, and professional engineering talents.

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