Teaching Class of Mineral Processing Course System Based on Intelligent Simulation Technology

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Abstract: Energy industry has a great influence on the development of national economy, and mineral processing engineering is an applied technology subject mainly studying mineral separation, which can train a large number of mineral processing engineers for the country, and is conducive to promoting the development of energy industry in China. In order to Promote Colleges and universities to cultivate a group of qualified talents in mineral processing technology, this paper carries out a classroom research on the teaching of mineral processing curriculum system based on intelligent simulation technology. This paper analyzes the shortcomings of the traditional classroom teaching mode of mineral processing through experimental comparison, and summarizes the advantages of intelligent simulation technology in the teaching of mineral processing curriculum system. Through the research, this paper concludes that The number of students with good grades in class B of experimental group is 32 and 36 respectively, which is far higher than that in class a of control group, which is 20 and 17 respectively. The experiment fully demonstrates the feasibility of teaching in mineral processing course system based on intelligent simulation technology.

1. Introduction

At present, there are more than 30 colleges and universities with the major of mineral processing engineering in China. Although the specialty has distinct characteristics, compared with some popular specialties, the mineral processing engineering specialty has received relatively less attention [1-2]. Many students who apply for the major know little about it. Especially in recent years, with the decline of the coal situation, the enrollment and employment of coal college students have also had a greater impact, leading to some freshmen lose interest in learning and self-confidence in their major at the beginning of enrollment, and the phenomenon of blindly following the trend appears. Through the study of professional introduction, students can fully understand their major, which is conducive to cultivating students' professional interest and improving their professional identity [3-4].

In view of the current downturn in the mining industry, certain reforms should be carried out in the discipline of mineral processing engineering to optimize the allocation of courses, Optimize the teaching methods, improve the traditional teaching mode [5-6], based on this paper, carry out the classroom research on the mineral processing curriculum system based on intelligent simulation technology, explore the new teaching methods of the mineral processing curriculum system [7-8], improve the personnel training program of mineral engineering, so as to promote the internationalization of the mineral processing engineering major in Colleges and universities [9-10].

This paper first introduces the intelligent simulation technology, then briefly introduces the mineral processing engineering specialty and its development history, summarizes the disadvantages of the traditional mineral processing engineering curriculum system, and then through the experimental comparison of two classes of a university's ore processing engineering specialty, through the experimental comparison results, sums up the teaching based on the intelligent simulation technology in the mineral processing curriculum system The feasibility and advantages of learning the classroom.

2. Proposed Method

2.1 Intelligent Simulation Technology

Intelligent simulation technology is the product of the era of science and technology, has been applied to all aspects of life. Neural network technology is an intelligent technology. It simulates the structure and function of human brain and finally forms learning ability. In the field of artificial intelligence, it has been used in decision support, pattern recognition, expert system, machine learning and other fields.

At present, the most widely used neural network model is BP neural network model, which is simple in structure, stable in working state and easy to realize in hardware.

BP neural network node unit characteristics (transfer function) are usually sigmoid type, namely:

$$f(x) = \frac{1}{[1 + \exp(-Bx)]} \tag{1}$$

The input signal passes through each hidden layer node from the input layer node once and then to the output node. The output of each layer node only affects the output of the next layer node.

BP network can be regarded as a highly nonlinear mapping from input to output, namely:

$$F : R^n \to R^m,\ f(x) = Y \tag{2}$$

There is a mapping for the sample set:

$$g(x_i) = y_i,\ i = 1,2,3,\ldots,n \tag{3}$$

BP neural network can approximate complex function by several times compounding simple nonlinear function.

2.2 Introduction to Mineral Processing Engineering

Mineral processing engineering is a national key discipline characterized by coal. It mainly trains high-level engineering talents engaged in mineral (coal, metal, non-metal) separation and processing and comprehensive utilization of mineral resources in the fields of production, design, scientific research and development, and technical transformation and management. Mineral processing engineering has experienced many adjustments and changes. At first, in the 19th century, mineral processing was only an auxiliary discipline of mining or metallurgy. In the 1930s, mineral processing engineering developed rapidly, and the discipline grew continuously. It was also independent from its dependent disciplines. Its field was divided into the field of mineral selection, which contained relatively narrow content and design scope. Then in the 1960s, The major has made in-depth research on beneficiation methods, extending to gravity separation, magnetic separation and electric separation. Until the early 21st century, mineral processing has become a relatively mature discipline, named mineral processing engineering.

3. Experiments

3.1 Research object

The students of two classes of 2019 mineral processing engineering major in a university are the total samples of the study. Using the method of random cluster sampling, 52 students from one class are selected. Using the traditional teaching method, the students are set as the control group, which is called class A, and 50 students from the other class. The students are set as the experimental group, which is called class B.

3.2 Test content

The experimental period is one semester. According to the curriculum system structure of mineral processing engineering, the credit proportion of basic courses and practical courses is emphasized. The system structure of the course is 100 credits, including 77 credits for theory and 23 credits for practice. At the end of the experiment, the final scores of class A and class B are evaluated according to the scope shown in Table 1. The experimental evaluation is based on the overall evaluation scores (five-level system, excellent, good, medium, pass and fail).

Table 1. Assessment contents of mineral processing engineering curriculum system

Class hours	Credit		Credits / total credits,%	Excellent (points)	Good (score)	Medium (score)	Pass (score)	Fail (points)
	Theoretical credits	Practical credits						
340	14	4	18	90-100	80-89	70-79	60-69	＜60
688	35	8	43					
448	28	11	39					

4. Discussion

4.1 Disadvantages of Traditional Mineral Processing Curriculum System

4.1.1 Rigid educational model

(1)The talent training program remains unchanged

Colleges and universities mainly through internal discussion to develop talent training programs, there are generally long discussion cycle, the effect is not obvious shortcomings. From the perspective of students, the traditional talent training program does not keep pace with the times, which makes students unable to adapt to the needs of the industry in the new era after they go out of the campus. For example, in the face of the innovation of mineral processing technology, students do not learn in time, so they cannot be recognized by enterprises, which leads to students' difficulty in employment or unemployment. From the perspective of teachers, the traditional talent training program is not conducive to the enthusiasm of teachers, Teachers repeat a set of talent training program day by day and year by year, which will hit the enthusiasm of teachers, so they can not improve their teaching ability.

(2) Lack of distinct training objectives

In most colleges and universities, there is a general problem that the training objectives are not clear. When making the training objectives, we do not proceed from the reality, and do not fully consider the teachers' strength of the school itself and the actual needs of various social enterprises. For most enterprises, they hope that graduates can be full of vitality and provide innovative solutions for the company, while most students have no innovation awareness and can not meet the needs of enterprises. For students, if their knowledge is not enough to meet the needs of modern society, it will affect their self-confidence to a certain extent.

(3) The training program is not comprehensive enough

Modern education attaches great importance to the all-round development of students, but in fact, all colleges and universities attach too much importance to the professionalism and scientificity of their engineering majors, so that students ignore the actual situation in engineering. In the specific training process, students only care about their own professional ability, but do not pay attention to the actual concept of the project, safety measures and other specific content, which is not conducive to the cultivation of students' ability to adapt, leading to the actual problems when they do not start from the project itself.

4.1.2 Solidification of practical teaching methods

In our country, the practice of mineral processing engineering in most colleges and universities is composed of two parts: the practice inside and outside the University. The practice inside the university is mainly divided into the experiment, curriculum design and graduation design of mineral processing specialty, while the practice outside the university is mainly to organize students to enter the enterprise and practice in the enterprise. However, in the specific practice process, there are a series of problems, including:

(1)In the school practice, most of the practical work is carried out under the guidance of relevant theories, so students are limited by fixed templates, unable to play their own initiative, resulting in the failure to improve their innovation ability.

(2) In the off campus practice, because there is no long-term cooperation mechanism between the school and the enterprise, the school can not arrange students to practice in the enterprise at will. At the same time, most enterprises are not willing to participate in the school's talent training plan based on safety considerations.

(3)Most colleges and universities have high requirements for the education background of teaching staff, but the actual situation is that the talents with high education background do not have enough practical experience, and the talents with enough practical experience do not meet the school standards, while the teachers with high education background and enough practical experience are in short supply.

4.1.3 Unscientific way of talent assessment

While colleges and universities attach great importance to the cultivation of talents, they should also make corresponding changes in the way of talent assessment. If there are problems in the way of talent assessment, it will lead to the failure of the ultimately trained talents to make effective contributions to the society. At present, most colleges and universities assess students' learning ability by means of basic knowledge test, and students memorize theoretical knowledge to ensure the smooth passing of the test, which is undoubtedly not conducive to the cultivation of real talents. When students practice outside the school, they often take the result of practice report as the evaluation standard, but do not pay attention to the examination of students' practical ability, and ultimately can not achieve the purpose of practice outside the school. For the students of mineral processing engineering, the most effective way of assessment is on-the-spot examination. Only from the actual practice can we find and solve problems.

4.1.4 Subject system problems

In some schools, the discipline of mineral processing engineering has the phenomenon of separation of discipline development and training objectives, and a new discipline system has not been formed through the organic combination of the two. Teachers have also been arguing about the professional orientation of mineral processing engineering. In specific cases, there are differences between the opinions of professional leaders and teachers, The research field with research results has not been refined in disciplines, the excellent discipline direction has not been summarized, and the integration with the times and the extension of new fields are not enough.

4.1.5 Curriculum problems

The unclear training objectives and vague professional training objectives lead to frequent changes in the formulation of training programs, which are changing every year or even every quarter. The nature of courses is also changing too fast. Many courses are constantly changing between elective and compulsory courses. For schools, because the research fields of introducing talents are quite different, it is difficult to integrate and form a unified research system. The number of courses is large, but it is not detailed enough. Students' course selection is scattered, which reduces teachers' enthusiasm in class and wastes teaching resources.

4.2 Analysis of Experimental Results

In order to solve the problems existing in the traditional mineral processing course system and verify the application effect of intelligent simulation technology in the teaching classroom of mineral processing course system, the experimental comparison is conducted with two classes of 2019 in mineral processing engineering major as the research object, and the student scores of two classes as the comparison, and the results are shown in Figure 1.

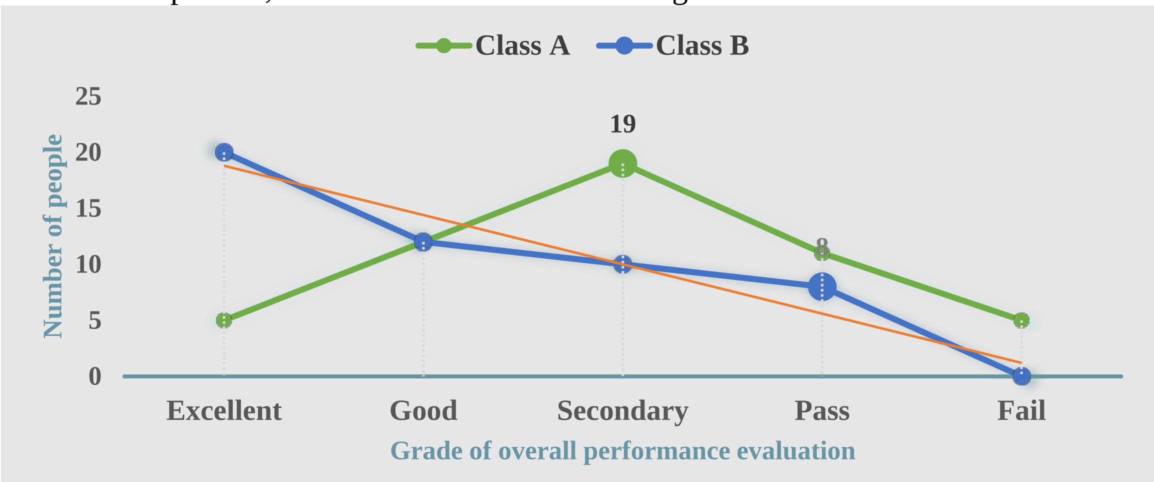

Figure 1. Grade comparison of class general evaluation

It can be seen from Figure 1 that the number of excellent students in class A is only 5, while that in class B is as high as 20. The number of good students in class A is 12, and that in class B is 12. The number of middle students in class A is 19, that in class B is 10, that in class A is 11, that in class B is 8, that in class A is 5, and that in class B is 0 The results are mainly between passing and good, with 42 students, while the total scores of class B are mainly above good, with 32 students. It can be seen that the grade of class B is two grades higher than that of class A.

In order to further analyze the teaching effect of intelligent simulation technology in the course system of mineral processing, this paper statistics the number and proportion of two classes with good scores in three teaching systems. The statistical results are shown in Table 2 and Figure 2.

Table 2. Analysis of good scores of each teaching module

Teaching module	Class A		Class B	
	Number of people	Proportion	Number of people	Proportion
Public basic courses	37	71%	35	70%
Basic courses	20	38%	32	64%
Major required courses	17	33%	36	72%

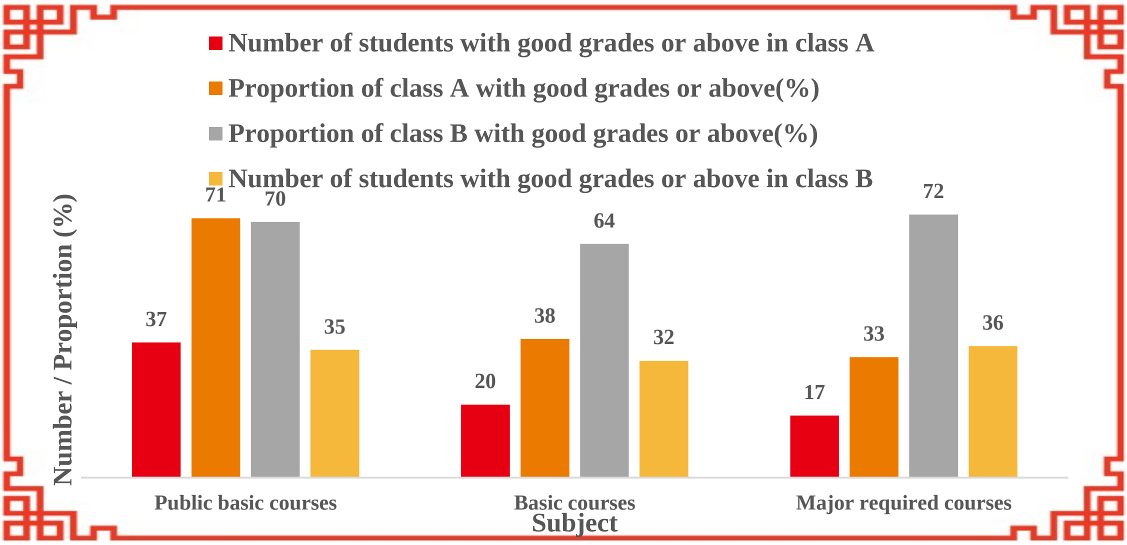

Figure 2. Analysis of good scores of each teaching modul

It can be seen from Figure 2 and Table 2 that the number of class A with good performance in the public basic course system is 37, accounting for about 71% of the total number, and the number of class B with good performance in the public basic course system is 35, accounting for about 70% of the total number. It can be seen that the gap between the two classes in the public basic course system is very small, because the teaching of this course system does not involve intelligent simulation technology Technology teaching, and then in the discipline based system and professional compulsory course system, the gap is very obvious, because the two teaching systems class A and class B use different teaching methods, class a uses traditional teaching methods, class B uses intelligent simulation technology to teach mineral processing course, class A has a good score in the discipline based course system, and the number of people above 20 There are 38% of the total number of students in the class, 32 in class B, 64% in class B, 17 in class A, 33% in class A, 36 in class B, 72% in class B, as can be seen from the figure above The results of class B with the new model are significantly higher than that of class A.

It can be seen that the effect of intelligent simulation technology in the teaching classroom of mineral processing course system fully proves the feasibility of applying the intelligent simulation technology discussed in this experiment to the teaching classroom of mineral processing course system.

5. Conclusions

The development and improvement of the undergraduate teaching of mineral processing specialty is not only related to the quality of the professional training, but also related to the healthy development of China's geological and mineral industry. Based on the research of the teaching classroom of mineral processing course system based on intelligent simulation technology, this paper summarizes the need of deepening the teaching reform, improving the teaching quality, constantly updating the teaching concept, and making the teaching method adapt to the social progress. Only in this way, can we realize the leap forward development of the undergraduate teaching of mineral processing engineering.

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