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Exploration and Practice of Teaching Reform of "Geological Disaster Prevention and Control" Course Based on the Background of New Engineering Disciplines

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Abstract. Safety engineering of Kunming University of Science and Technology can provide support for the cultivation of professional and technical talents in disaster prevention, mitigation and relief, and "Geological Disaster Prevention and Control" is one of the basic main courses and 8 professional core courses of Safety Engineering. This paper, based on the background of new engineering disciplines, explores the course teaching reform from eight aspects, such as revising the course syllabus, improving and reconstructing the course teaching content, innovating the interactive teaching mode in classroom, constructing a three-dimensional virtual simulation practice platform that combines theory and practice of the course, carrying out professional ethics education for students in the whole process, actively integrating the ideological education of the course, inviting famous experts at home and abroad to deliver lectures to students, and completing the diversified evaluation methods of the course. The course has achieved significant results through practical teaching, and is of great significance to the cultivation of security professionals who match the strategic demands of national disaster prevention, mitigation and relief.

Keywords: New engineering disciplines; geological disaster prevention and control; safety engineering; teaching reform; disaster prevention, mitigation and relief

1. Introduction

In February 2017, the Ministry of Education officially launched the construction of new engineering disciplines based on the new needs of national strategic development, the new situation of international competition and the new requirements of moral education, and formed "Fudan Consensus", "Tianda Action" and "Beijing Guide" sequentially, and issued the "Notice on Research and Practice of New Engineering Disciplines " and "Notice on Recommending Research and Practice Projects of New Engineering" [1].At the same time, in June 2017, the Ministry of Education released "the Guide of New Engineering Disciplines Research and Practice Projects", in which five major research themes such as new concept, new structure, new model, new quality and new system and 24 research directions for the construction of new engineering disciplines are clearly defined [2]. From this, it can be seen that the new engineering disciplines is led by moral cultivation and aims at cultivating diversified and application-oriented excellent engineering talents, which has the typical strategy, innovative, systematic and open characteristics [3,4].

Safety Engineering is an engineering discipline. It refers to the methods, means and measures of various safety technologies and their comprehensive integration applied in the specific field of

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safety existence in order to guarantee the dynamic security of human body. The practice of safety engineering provides direct and indirect guarantees to ensure that people's lives and health are safeguarded and their bodies and their equipment and property are not damaged in production and life; safety engineering professionals play a crucial role in preventing and controlling accidents and reducing the negative effects of accidents, and whose graduates should be well-rounded in moral, intellectual and physical development, with solid foundation, broad knowledge, strong ability, high quality, innovative spirit and humanistic quality [5]. The major of safety engineering of Kunming University of Science and Technology is a national first-class undergraduate course, which has been enrolled since 2002, and there are three cultivation directions of geological hazards and prevention, mining safety and monitoring, and civil engineering safety and disaster prevention; "Geological Hazards Prevention and Control" is one of the basic main courses and eight professional core courses of "the Major of Safety Engineering", which has strong pioneering, basic and practical nature. Therefore, on the basis of the background of new engineering disciplines and with the goal of cultivating high-quality technical talents in disaster prevention, mitigation and relief, it is important to explore the teaching reform of the course "Geological Disaster Prevention and Control" to support and guide the cultivation of professional technical talents in safety engineering.

2. Exploring the teaching reform of "Geological Disaster Prevention and Control" course based on the background of new engineering discipline

Combining with the situation of Yunnan Province, which is a geological disaster-frequent province, the university's positioning as a "research and teaching university" and the construction action plan of "new engineering discipline", the school is oriented to improve students' ability to comprehensively analyze and solve actual geological disaster prevention and control problems, to promote the guiding function of Xi Jinping's Socialist Ideology with Chinese characteristics in geological disaster prevention, mitigation and relief, to closely integrate disaster prevention, mitigation and relief into the overall national security strategy and the overall economic and social development, and to thoroughly implement Gene 、 45 Secretary Xi Jinping's proposal of "strengthening disaster risk prevention measures, reinforcing disaster risk investigation and management, and fully to improve the spirit of the instruction of the national comprehensive disaster prevention, mitigation and relief capacity". At the same time, in order to carry out the "Several Comments on Deepening the Reform and Innovation of Ideological and Political Theory Courses in New Era" of the General Office of the CPC Central Committee and the General Office of the State Council, the Ministry of Education issued guidance documents on the construction of "Guideline on the Construction of Curriculum Ideology in Higher Education" etc.; on the basis of insisting on innovative talent cultivation and implementing moral education, the teaching team has carried out the following 8 aspects of teaching reform exploration for the course of "Geological Disaster Prevention and Control" in recent years with the background of new engineering disciplines:

2.1 Taking the national strategy for disaster prevention, mitigation and relief and the relevant guiding documents issued by the State Council and the Ministry of Education for the construction of the ideological and political curriculum as the guide, revise the course syllabus containing the organic unity of ideological and political education and knowledge system education

The Party Central Committee and the State Council have always attached great importance to disaster prevention, mitigation and relief work and the construction of higher education curriculum thinking. On the one hand, in 2018, General Secretary Xi Jinping presided over the third meeting of the central finance and economics commission to conduct a special study on the issue of improving natural disaster prevention and control capacity, emphasize the need to establish an efficient and scientific natural disaster prevention and control system and improve the capacity of the whole

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society to prevent and control natural disasters, and to promote the construction of several major projects for critical areas and weak links[6]. In 2021, the State Council Li Keqiang made important instructions on disaster prevention, mitigation and relief, pointed out that we should further strengthen the implementation of responsibilities, perfected the system of disaster prevention, mitigation and relief plans and all preparations, enhanced rescue capabilities, and improved public awareness of disaster prevention to minimize the risk of natural disasters and losses[7]. On the other hand, the General Office of the CPC Central Committee and the General Office of the State Council issued "Several Opinions on Deepening the Reform and Innovation of Ideological and Political Theory Classes in New Era Schools", the Ministry of Education issued "Guidance Outline of Curriculum Ideological and Political Construction in Higher Education" , etc. The guiding documents of ideological and political construction require the ideological and political education to run through the whole process of talent training.

The teaching team revised the course syllabus to solve the problem that the course syllabus could not keep up with the national strategy and could not meet the requirements of the construction of the course ideology.

2.2 Based on course ideological construction strategic initiatives, critical tasks and target requirements and the latest research results in the field of geological disasters, improve and reconstruct course teaching content, and realize the mutual integration of course knowledge education and ideological and political education

"Geological Disaster Prevention and Control", as a highly practical core professional course, in order to meet the systematic, forward-looking, fundamental and strategic development needs of the country for disaster prevention, mitigation and relief work, and at the same time to meet the training objectives of cultivating innovative talents and implementing moral education, under the guidance of Xi Jinping's Socialist Ideology with Chinese Characteristics for a New Era in geological disaster prevention, mitigation and relief, the teaching team has based on the strategic initiatives, important tasks and target requirements for the construction of the course in accordance with the guidance documents issued by the State Council and the Ministry of Education; at the same time; meanwhile, the latest research theories and technical methods in the field of geohazards at home and abroad are continuously integrated into the teaching contents and the current outdated teaching contents are deleted to improve and reconstruct the teaching contents of the course.

At present, the teaching team has built the teaching resources including 16 sets of literature libraries, 21 case libraries and 57 sets of video libraries, which increase the breadth and depth of teaching contents and facilitate students to better understand and master the course contents.

2.3 Innovating "student-centered, classroom and off-class integration" to achieve the interactive teaching model that unifies knowledge teaching, value building and ability cultivation in multiple ways, stimulate students' interest in independent learning and guide them to think deeply about problems

In order to solve the contradiction between less teaching hours and more course contents and the teaching problem that students do not learn enough independently and are not willing to think, as well as to effectively solve the problem of "two skins" between professional education and ideological education, the teaching team innovates a four-in-one interactive teaching method of "self-study in groups before class - regular report by students in class - lecture and interactive communication by teachers in class - post-class training and expansion", which can realize the unity of knowledge teaching, value shaping and ability cultivation, and stimulate students' interest in independent learning and guide them to think deeply about the problems.

The teaching method has been widely used in the current teaching process with good results, and ensures that the ratio of students' independent learning time to classroom teaching time exceeds 3, and cultivates students' ability of independent learning and thinking about problems.

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2.4 Building a three-dimensional virtual simulation platform that integrates theory and practice to exercise students' ability of practical operation and spirit of teamwork, and improve students' ability to correctly identify, analyze and solve problems

Based on the difficulty of theoretical knowledge and abstract course content, students cannot fully understand the problem of teaching content, the teaching team built a three-dimensional virtual simulation test platform and corresponding operation manuals for rainfall-induced landslide, artificial excavation-induced landslide, rainfall-induced slope debris flow, flood-induced gully debris flow, tunnel (roadway) excavation-induced ground collapse (ground subsidence, ground fracture), mining-induced ground collapse (ground subsidence, ground fracture) and loose geotechnical body grouting reinforcement.

The three-dimensional virtual simulation test platform built by the combination of theory and practice can not only help students understand the obscure course content iconically; but also integrate the three-dimensional simulation virtual test operation on the basis of traditional theoretical lectures, which can intuitively and conveniently carry out exercises on the causes, prevention and emergency response of geological hazards; at the same time, it can also help students participate in innovation projects and national university student practice and innovation competitions, which really achieves the good effect of promoting learning through competition. On the one hand, it exercises students' practical operation ability and teamwork spirit; on the other hand, it improves students' ability to understand, analyze and solve problems correctly.

2.5 The whole process of the course carries out students' professional ideal and professional ethics education, cultivates students' law-abiding, honest and trustworthy behavior habits and dedicated to research and innovative scientific quality

The course actively guides students to understand and consciously practice the professional spirit and professional norms related to the work in the field of geological disaster prevention and control while teaching professional knowledge, and increase students' sense of professional belonging and responsibility. On the one hand, the course cultivates students' professional behavioral habits of law-abiding, career-loving, selfless dedication, honesty and trustworthiness, and fairness, and on the other hand, it stimulates students' diligent research and innovative scientific quality.

2.6 The course reinforces "five loves" and engineering ethics education in the whole process, actively integrates with the course ideology education, adheres to moral education, and cultivates students' great artisan spirit and the family sentiment and mission of serving the country with science and technology.

In response to the requirements of the State Council and the Ministry of Education, this course carries out education on "five loves" (i.e. love for the Party, love for the country, love for socialism, love for the people and love for the collective) and engineering ethics in the form of interactive classroom communication and special lectures after class, which not only help students establish the concept of ecological civilization of "respecting nature, conforming to nature and protecting nature", but also enhance students' awareness of environmental protection of "clear water and green mountains are golden mountains", and cultivate students' spirit of craftsmanship of excellence. This will help students to shape a correct world view, life view and values, and inspire them to serve the country with science and technology.

2.7 Inviting renowned experts in the field from home and abroad to give pre-seminar lectures to students, creating opportunities for students to learn and communicate with academic experts

By inviting foreign academician Muhammad Asif Khan from the University of Peshawar, Pakistan,, Zhu Yingyan and Chen Ningsheng from the Chengdu Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, and Han Yongshun from Hunan University of Science and Technology, and other famous experts in the field of geological hazards at home and abroad to

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give pre-seminar lectures to students, students can not only learn about the latest research results in this field, but also create opportunities for students to learn and communicate with academic experts. The lectures not only allow students to learn about the latest research results in the field, but also create opportunities for students to learn and communicate with academic experts, and cultivate students' ability to communicate, express themselves and think about problems.

2.8 Consummating the diversified assessment methods that reflect the course ideology in the whole learning process, and focusing on the process evaluation that combines students' independent learning ability, in-depth thinking about problems and comprehensive analysis and problem-solving ability

The evaluation method used in the course is: comprehensive course grade = attendance (10%) + pre-class self-study and classroom reporting (30%) + post-class training and development (30%) + final exam results (30%). The course evaluation method not only changes the paper-based evaluation method, and reflects the non-standardized process evaluation and higher-order evaluation requirements of the course; but also the course ideological and political evaluation throughout the whole learning process of students, which can effectively assess the students' independent learning ability, in-depth thinking and comprehensive analysis and problem-solving ability.

3. Achievement of reform

The above teaching reforms have achieved the following remarkable results through teaching practice:

1) The course team hosts 11 teaching and reform projects at school level, including one national project and six provincial and ministerial projects, issues four reference textbooks and has published eight papers on teaching and reform; 5 times of the supported courses have won awards in classroom teaching competitions at school level and above, among which two times have won provincial and ministerial awards; at the same time, all the course team members have won the "Red Cloud Gardener" Excellent Teacher Award, and one of them has been awarded as a teaching master at Kunming University of Science and Technology.

2) The course is the core curriculum of safety engineering, resource exploration engineering, mining engineering and geological engineering, which are granted as the high-quality postgraduate courses in Yunnan province, the first-class and course quality grade domestic top courses of Kunming University of Science and Technology, and support the construction points of safety engineering, resource exploration engineering and mining engineering as the national first-class undergraduate majors.

3) The diversified teaching modes and methods have enhanced the students' motivation of independent learning and achieve good teaching effects, which have been highly praised by peers and teaching supervisors, with excellent evaluation results.

4) The resources such as literature library, case library, video library and virtual simulation test platform have been well received by students. These resources can not only reform the teaching mode by combining "virtual" and "real", and integrate three-dimensional simulation virtual test operations on the basis of traditional theoretical lectures, which can training the causes of geological hazards, prevention and emergency response in an intuitive and convenient way. Moreover, it can help students to participate in innovation projects and national university students' practice and innovation competitions, which can truly achieve the good effect of promoting learning through competition.

5) Students have acquired solid basic knowledge of geological hazards and good professional skills, so the course has also been highly evaluated by further education institutions (e.g., Institute of Mountain Hazards and Environment, Chinese Academy of Sciences) and employment units (Yunnan Institute of Geological Environment Monitoring).

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6) The rates of entrance to graduate school and initial employment (as of May 31, 2021) of the 2017 safety engineering majors with this course as the core curriculum are 41.38% and 79.31% respectively, both of which are the first in the whole university; the rate of entrance to graduate school is about 2.5 times of the average rate of entrance to graduate school in the whole university, and the employment rate exceeds the average employment rate of the province in the same period by as much as 30%.

7) Relying on this course, students were guided to win 8 science and technology innovation funds at school level or above, and were guided to win 21 awards in various discipline competitions at school level or above, among which 6 were national awards and 8 were provincial awards; at the same time, it helped the school to be approved by the Ministry of Human Resources and Social Security for the "2020 Advanced Training Program for Professional and Technical Talents Knowledge Renewal Project".

4. Summary

Safety Engineering of Kunming University of Science and Technology is a national first-class undergraduate major, which can provide support for the cultivation of professional and technical talents in disaster prevention, mitigation and relief. "Geological Disaster Prevention and Control" is one of the basic main courses and 8 professional core courses of the major of "Safety Engineering", which has strong pioneering, basic and practical characteristics. Based on the new engineering disciplines background, this paper explores and researches the teaching reform of the course "Geological Disaster Prevention and Control" from eight aspects, such as revising the course syllabus, perfecting and reconstructing the course teaching content, innovating the interactive teaching mode in classroom, building a three-dimensional virtual simulation practice platform combining theory and practice of the course, carrying out professional ethics education for students in the whole course, actively integrating the ideological education of the course, inviting famous experts at home and abroad to teach students, and improving the diversified assessment methods of the course, and the teaching practice has proved to be remarkably effective, which is of great significance to cultivate composite talents of security professionals who meet the needs of national disaster prevention, mitigation and relief strategies.

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