



Research on Cultivating College Students with Healthy Personality Based on the Course of Fire and Explosion Prevention Technology

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Abstract. The purpose of university education should not only improve cultural quality but also cultivate morality and healthy personality. Here, taking the course of fire and explosion prevention technology as example, the cultivating method was explored and practiced. First, the exploration of teaching elements was extracted from four aspects, i.e., the history of knowledge point, accident case, prevention and control technology of fire and explosion, and project assignment. Then, these elements were taught by suitable methods, for example, lecture method, PBL, discussion method and so on. Last, the evaluation of teaching effects was carried out through ideology homework, accident case analysis, scientific research subject competitions, and project assignments. The results indicated that the students have developed a sense of cooperation, responsibility, competition, innovation, scientific spirit and scientific development concept.

Keywords: University education; Healthy personality; Fire and explosion prevention technology; Accident case; The history of knowledge point; Research and competition.

1 Introduction

Since the new century, Chinese economy and society have made tremendous progress, which this put forward higher requirements for talent cultivation in higher education. The purpose of education has risen from imparting knowledge and skills to cultivating socialist builders and successors with total healthy personality, i.e., comprehensive moral, intellectual, physical, aesthetic, and labor development [1]. This has greatly promoted the formation of the moral education and talent cultivation model in Chinese higher education, ushering in a new stage of talent cultivation in higher education [2]. Science and engineering majors account for a considerable proportion of the university majors in China, so it is of great important to cultivate healthy personality in science and engineering courses. However, the teaching of science and engineering courses has focused on the systematic logic of knowledge content, and emphasized the course

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content itself and its application, and paying less attention to curriculum morality and personality education for a long time [3]. Therefore, it is necessary to excavate, sort out, supplement and improve teaching elements from scratch, and its practice needs to be explored and tried. In addition, due to limited class hours, extensive content, heavy teaching tasks, and so on, it is difficult to carry out morality and personality education in science and engineering courses [4]. Fire and explosion prevention technology is a core course in safety engineering major. Based on long-term teaching experience and a lot of literature, the method of morality and personality education in this course was proposed and practiced, which was hoped to contributing to the cultivation of major talents with comprehensive development in morality, intelligence, physical fitness, aesthetics, and labor. The morality and personality education scheme are shown in Figure 1.

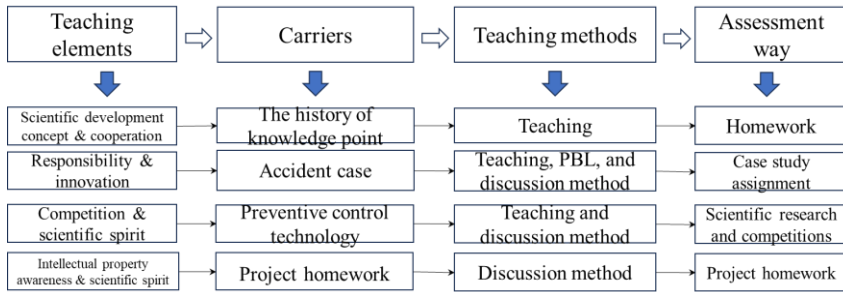


Fig. 1. Main morality and personality teaching elements of Fire and explosion prevention technology course and their implementation and evaluation methods

2 The Excavation and Practice of Morality and Personality Teaching Elements Based on Development History of Knowledge Point

2.1 The Excavation of Teaching Elements

The formation of concepts, theories, methods, techniques, and other knowledge points in any course is not achieved overnight, but rather involves a gradual process of development and improvement. These knowledge points are often completed through the joint efforts of many scholars from different eras, countries, and regions. This development process is usually not smooth sailing, but rather proposing ideas, verifying, correcting, re-proposing ideas, and re verifying... moving forward in a wave like manner and rising in a spiral like manner. Therefore, teaching the history of development history of knowledge point could help to cultivate scientific development concept, cooperation awareness, global awareness, and even establish a life philosophy of serving the people and contributing to society. There are many such contents in this course such as the essence of combustion, ignition theory, similarity rule in the calculation of explosion shock waves.

2.2 The Practice and Assessment of Morality and Personality Teaching

It is recommended to use lecture method, and directly assign homework for effectiveness evaluation. Taking the essence of combustion as an example. Its main contents include phlogiston theory, oxygen theory, molecular collision theory of combustion, activation energy theory of combustion, peroxide theory, and chain reaction theory. Each new theory is developed on the basis of the previous theory, and is a revision and improvement of the shortcomings of the previous theory. The students know that people's understanding of the essence of combustion is a process from shallow to deep, from ordinary philosophical conjecture to rigorous scientific verification, from Chinese Five Elements theory to Europe's phlogiston theory, and now the universally applicable chain reaction theory. From China to Europe, from Germany's Stahl to French chemist Lavoisier, to Britain's Hinshewood and Soviet scientist Semyonov, it has gone through more than 200 years of continuous efforts by countless people to obtain a universally applicable chain reaction theory. The students listened very attentively and understood the chain reaction theory at the end.

An open-ended question titled "Human understanding of the essence of combustion is a process from shallow to deep through the joint efforts of different countries and generations, what are your thoughts on this?" was set up. According to their answers, 100% of students have a comprehensive understanding of the scientific research process, and knowing the hardships and complexity of scientific exploration; 100% of students have a global awareness and realize the importance of cooperation and exchange between different countries and regions; 90% of students express gratitude for the hard work and dedication of their predecessors. They think they should take advantage of their youth, study hard, and strive to contribute to society.

3 The Excavation and Practice of Morality and Personality Teaching Elements Based on Accident Case

3.1 The Excavation of Teaching Elements

There are many fire and explosion accidents were reported in people's life, which caused heartbreaking casualties and property damage. For example, the 2024 Nanjing 2.23 high-rise residential building fire, the 2009 Caribbean Oil Company gasoline leak fire and explosion accident, the 2008 US Imperial Sugar Factory dust explosion accident, the 2015 Tianjin Port Ruihai atastrophic fire and explosion accident, and so on. These accident cases are often used for classroom teaching. Studying accident cases can cultivate students' sense of social responsibility and innovative spirit.

3.2 The Practice and Assessment of Morality and Personality Teaching

Lecture, discussion, and PBL can be used to carry out accident case teaching. For example, we used lecture method and discussion method to teach the 2024 Nanjing 2.23 high-rise residential building fire accident. Firstly, we played a video of the accident and introduced the course content. After explaining the content, students were guided

to use driving force knowledge to conduct in-depth analysis of accident cases and explain issues of public concern. Then, an assignment was assigned - how to prevent similar accidents from happening? Please conducting research and calculations for a high-rise building near you and answering this question and telling the people how to do? In the process of doing homework, students unconsciously develop a sense of social responsibility and professional confidence, and innovation.

In addition, we often adopted flipped classroom model for case teaching and case study assignment in small group for assessment. At the beginning of the course, students are organized to group and choose case content. The specific types of case analysis assignments include building fires, pool fires, vapor cloud explosions, and so on. Each of them contents different knowledge of the course, which will be gradually learned. During the teaching process, the group is required to complete case analysis assignments according in time. The content of a case study assignment usually includes an analysis report of about 5000 words and a PowerPoint presentation. And accident description, analysis of accident causes, statistics of similar accidents, prevention and control measures for similar accidents must be finished in the content of analysis report.

After the course, students realized that fires and explosions are a common problem among countries around the world, and many of them are related to human activities. They knew that many of these accidents can be prevented, which stimulates students' sense of social responsibility. They realized that people must flexibly apply theory and technology to prevent complex fire and explosion hazards. Whatmore, students felt the differences in fire and explosion prevention, emergency response method both domestically and internationally, which cultivated their patriotism [5]. In last year, their case study assignment participated the second Public Safety and Emergency Case Competition of the Emergency Technology and Management Alliance with case analysis assignments, and won one first prize, one second prize, and one third prize each.

4 The Excavation and Practice of Morality and Personality Teaching Elements Based on the Content of Fire and Explosion Prevention Technology

4.1 The Excavation of Teaching Elements

There are many fires and explosion prevention and control technologies in the course, such as flame-retardant technology, fire detection and alarm technology, fire extinguishing technology, structural fire resistance, smoke control, and so on. Most of them was of strong professionalism and development potential. We often provided opportunities for students to participate in engineering projects to guide them applying these technologies to solve practical problems or encourage them develop new technologies and methods by experimental method or numerical calculation. This could cultivate students' scientific spirit, competitive awareness and the ability and professional confidence to solve complex engineering problems [2].

4.2 The Practice and Assessment of Morality and Personality Teaching

Lecture, discussion, and PBL can be used to carry out this content. We often introduce their application by actual engineering application projects and introduce frontier advances in relative research, and then invite them to participate in competitions and scientific researches. These competitions and scientific researches were conducted by many teachers and researchers throughout the school.

For example, in last year, in the term of fire detector and alarm technology and fire extinguishing technology, one group developed a small lithium battery thermal runaway warning and intelligent response system based on experimental study on thermal runaway of lithium-ion batteries and fine water mist fire extinguishing technology. This system can be used for safety monitoring and emergency response during the use of lithium-ion batteries, as well as an experimental device. The system won second prize in the 9th National College Safety Science and Engineering College Student Practice and Innovation Works Competition, and won first prize in the second undergraduate safety and emergency practice creative competition of the Chonglao Cup.

In addition, the other groups students participated in two university level innovation projects, two provincial-level innovation projects, and one national level innovation project for college students. One group developed flame retardant materials that won the National Life Science Competition and the third prize in the country. A student participated in the 2024 National College Student Career Planning Competition with the career goal of being a safety engineering material worker and won a bronze medal. They submitted their research results to various journals and three was accepted. The completion of these competition projects and scientific research further cultivates students' research abilities and competitive awareness. The publication of their papers and the receipt of awards greatly enhance their confidence and professional pride.

5 The Excavation and Practice of Morality and Personality Teaching Elements Based on Project Homework

5.1 The Excavation of Teaching Elements

Project assignment is another morality and personality teaching elements, such as explosion-proof design of a painting workshop, fire extinguisher configuration design of a building, graphic layout design of tank group, and so on. Which can deepen students' understanding and mastery of knowledge, improve their ability to apply knowledge, and thus achieve the teaching objectives. In order to complete the project assignment, it is often necessary to consult literature or standards, communicate with each other, consult and exchange ideas with corporate mentors and class teachers. This can make students know to correctly refer to the research results of others and cultivate their awareness of intellectual property rights. This can also train students' scientific spirit to strive for excellence and awareness and ability of communication and cooperation.

5.2 The Practice and Assessment of Morality and Personality Teaching

We invited a local fire department expert as a corporate mentor to participate in the teaching of "fire extinguishing technology" and guiding the project assignments. The title of the project homework was "Design of Fire Extinguisher Configuration in *** Buildings". Structural diagrams of buildings, building information, and functional information, as well as relevant standards and literature catalogs were provided.

To complete the homework, students first looked up documents and standards. Then, based on the given building structure and functional data, they divided the units and choose the type of fire extinguisher according to the given building structure and functional data. Next, they performed various calculations. During the design process, they consulted relevant literature and discussed with supervisors. Finally, they write the instruction and draw the drawings, presented and defended. According to students' design specifications, the citation and writing format of the references meet the requirements, demonstrating their awareness of intellectual property rights and a habit of respecting the labor achievements of others. So, the finish of project homework indicated the obtain of intellectual property awareness, scientific spirit and the ability of cooperation and communication.

6 Conclusion

Fire and explosion prevention technology is a core professional course for safety engineering major. Based on the characteristics of the course, the excavation of morality and personality teaching elements were carried out from four aspects, i.e., the development history of knowledge points, accident cases, fire and explosion prevention and control technologies, and project homework. The teaching was practiced by adopting teaching methods such as lectures, PBL, and discussion. The effect of morality and personality teaching were assessed through assignments, research, and competitions. For the development history of knowledge points, the effectiveness evaluation directly assigned to an open-ended ideological and political questions. For the accident case and project homework, the effectiveness evaluation was integrated into the evaluation of total class assignment. For fire and explosion prevention and control technology, the students participated scientific research projects and competitions to conduct deeply in-depth morality and personality training. The results showed that the excavation of morality and personality elements and their implementation of teaching did not affect the difficulty and depth of the course, but strengthened students' understanding of difficult content. The course teaching has totally achieved the goal of healthy personality. We hope that the research results of this article can provide practical reference for morality and personality education in science and engineering courses.

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