

# Research and Practice on Compound Talents Training Model of Safety Management—A Case Study from Xi'an University of Science and Technology

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**Abstract**—The current frequent occurrence of major accidents shows the urgent need of the society for compound talents in safety management. At present, the training of safety engineering talents in colleges and universities is more prominent in the safety knowledge and skills of students in their professional fields. Therefore, by analyzing the problems existing in the training of safety engineering professionals in engineering colleges and universities, the necessity of cultivating safety management talents has been discussed. According to the questionnaire, we can understand the social needs of safety management talents and analyze the knowledge structure of safety management talents. It also introduces the attempts of Xi'an University of Science and Technology(XUST) in the training of safety management compound talents. Through exploring the training method of safety management compound talents, it provides a reference for improving students' comprehensive practical ability and innovative ability in safety technology and management.

**Index Terms**—safety management; compound talents; knowledge structure; talent training model

## I. INTRODUCTION

As we all know, safety management is one of the three major countermeasures for preventing accidents, and it is an important aspect of preventing accidents. The frequent occurrence of production safety and occupational health problems in the industrial field shows that the scientific research and management of safety lag behind the actual needs of society. The lack of safety management (engineering) teachers, the lack of safety culture, and the general lack of safety management system thinking and safety literacy among employees are the main reasons for the current high incidence of accidents. In the face of emergencies and accidents, crises often cannot be dealt with in a timely and effective manner. For example, a group of severe and extraordinarily serious production safety accidents represented by the 2013 Jilin Dehui Baoyuanfeng fire accident, the Kunshan dust explosion

accident in 2014, and the Tianjin Port hazardous chemical explosion accident in 2015 were all liability accidents, all reflecting the incident unit Security management loopholes.

A survey organized by the National Safety Engineering Specialty Teaching Steering Committee indicated that “the quality of existing safety professionals in our country is incompatible with the requirements of social development. The teaching goal of the safety engineering specialty should be towards the 21st century, with equal emphasis on safety management and technology, and knowledge General education with comprehensive quality and depth and comprehensive quality. “In today's era, all high-tech achievements are the result of multidisciplinary interdisciplinary integration [1]. Therefore, how to train high-quality “composite” safety management talents to meet the needs of safety development has become a prominent issue facing the higher education safety engineering profession. From the perspective of actual needs and long-term strategies, the field of safety production urgently needs a large number of high-quality, knowledgeable, skilled, and complex management personnel.

## II. PROBLEMS EXISTING IN THE CULTIVATION OF COMPREHENSIVE TALENTS IN SAFETY MANAGEMENT

The so-called compound talents generally refer to those who have the basic knowledge and basic abilities of two (or more than two) majors and are able to engage in this major or related majors and marginal disciplines [2]. At this stage, there are more than 120 colleges and universities in China who have opened undergraduate majors in safety engineering. Each university focuses on the direction of “generalized safety” and maintains industry characteristics for safety issues in a specific field, such as coal mine safety, chemical safety, construction safety, Safety, civil aviation flight safety, etc. On the whole, the undergraduate curriculum system is based on a comprehensive theoretical foundation, and only in the postgraduate phase will it be subdivided into different

specialties such as safety technology and safety management. The training of safety engineering talents in colleges and universities is more prominent in the safety knowledge and skills of students in their professional fields. It is often “engineering vision” or even “pure engineering vision”, “emphasis on intelligence and moral education, theory and practice, knowledge and ability, and commonality. The phenomenon of “more intellectual development than moral education, more theory than practice, more knowledge than ability, more similarity than personality, more science and technology than humanities, more specialty than foundation, more utility than quality” is widespread, which results in weak practical ability and lack of innovative ability of college students. Therefore, it is not a combination of talents that cannot be trained to meet the actual needs of society.

Judging from the current development trend, the intersection of safety and management disciplines can integrate the paradigms of different disciplines, and promote research in areas that were previously neglected by professional disciplines, such as behavioral safety and the third category of hazard sources, breaking the “technology-only theory” The phenomenon of professional monopoly; increased communication between various disciplines through the intersection of security and management disciplines, and formed many new disciplines, such as security economics; etc.; the interdisciplinary discipline of security management focuses on “problem-solving” research models, Promotes the resolution of many important safety management practices.

### III. KNOWLEDGE MANAGEMENT MODEL OF COMPOUND TALENTS IN SAFETY MANAGEMENT

#### A. Survey on Social Needs of Safety Management Compound Talents

Through compiling and distributing the questionnaire “Social Needs Survey Questionnaire for Safety Management Professionals” to understand the social needs of safety management talents. The questionnaire is designed from the actual needs of employers, the knowledge and quality capabilities that safety professionals should have, and the outstanding issues that graduates of safety majors have in their actual positions. Facing 40 issued by universities, 25 were recovered; 10 companies were selected in the industrial, mining, and commerce and trade fields with relatively high risks such as coal mines, machinery, chemicals, petroleum, special equipment, fire protection, and non-coal mines, and strong demand for safety management personnel Questionnaire.

The study found that universities and enterprises generally consider that “safety management and safety technology combined with heavy talents in specific industries” are the most needed safety professionals in the company; as safety professionals, the top three who should pay more attention to mastering and strengthening their knowledge are “Safety technology”, “risk assessment”, “safety laws and regulations”, universities focus on technological innovation, enterprises focus on

legal compliance; the major problems that graduates of security majors have in their actual positions are mainly “lack of professional background knowledge of industry characteristics”, “safety professional knowledge learned needs to be disconnected from the actual work”, “weak practical ability”, “insufficient knowledge of regulations and standards in related industries” and so on.

#### B. Analysis of Knowledge Structure of Safety Management Compound Talents

The so-called knowledge structure refers to the state of a person's knowledge composition, that is, the multiple factors, multiple series, and multiple levels of the intellectual factors formed by the external knowledge system through the subject's input, storage, and processing and internalized in the mind Dynamic complex. To analyze the knowledge structure of safety management compound talents, we must first understand the requirements for talent quality, as shown in Fig. 1.

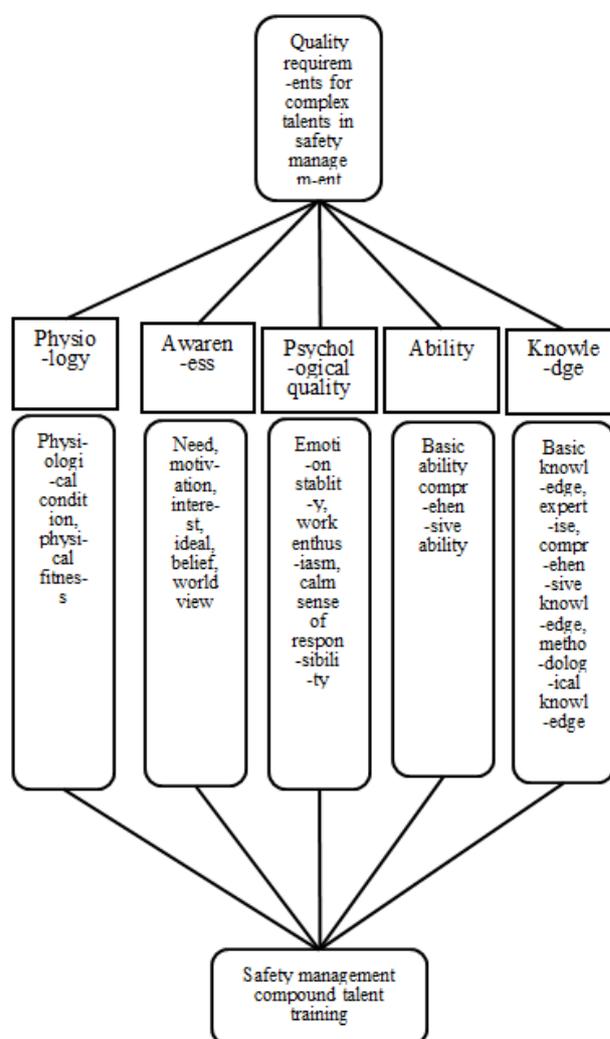


Figure 1. Schematic diagram of the quality requirements of safety management compound talents

The basic framework of the knowledge structure system of college students is composed of three major elements: basic knowledge, professional basic knowledge and professional knowledge. Its main content includes

basic knowledge structure system, professional knowledge structure system, tool knowledge structure system and method knowledge structure system. By analyzing the curriculum system setting of the safety engineering majors of eight domestic top safety engineering majors, the knowledge structure pattern of safety majors that are relatively common in Chinese universities in the emergence stage is shown in Fig. 2.

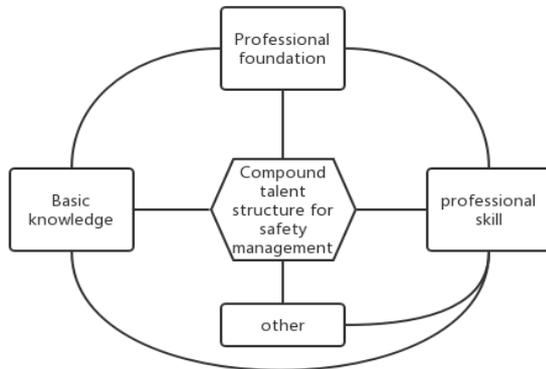


Figure 2. Knowledge structure model of safety management compound talents

#### 1) Professional skill

Among them, the types of safety management compound talents include: safety engineering technology design research, safety technology application consulting type, safety management supervision and inspection type, non-specific industry safety management and safety technology and heavy-duty; the types of safety knowledge mastered are: safety science Basic theory, safety laws and regulations, safety management, safety technology, safety economics, insurance knowledge, accident case analysis, risk assessment, computer application, foreign languages, etc. [3]; the quality capabilities that are valued are: independent working ability, organizational ability, Innovative ability, writing ability, comprehensive analysis ability, oral expression ability, self-learning ability, communication ability, contingency ability, etc.

#### 2) Professional foundation

Analyze professional skills, determine the required basic knowledge, and use the student's mastery as the basis for arranging course hours, including: major (safety) foundation, minor (management) foundation, and interdisciplinary application foundation.

#### 3) Basic knowledge

Analyze the professional foundation, determine the basic knowledge required for the profession, and use the professional background and assessment of the difficulty of the course as the basis for class hours, including: mathematics and natural sciences, social sciences, linguistics, etc.

#### 4) Other

In view of the comprehensive development of moral, intellectual, and physical training in talent cultivation, it is determined that other courses that should be offered and organized for learning and ability training include: sports, philosophy and psychology, history, literature and art, mental health, and employment guidance.

## IV. EXPLORATION OF XI'AN UNIVERSITY OF SCIENCE AND TECHNOLOGY SAFETY MANAGEMENT COMPOUND TALENT TRAINING

### A. Training Objectives

The major of safety engineering is one of the earliest majors established by Xi'an University of Science and Technology. It is listed as a national key construction major, and has become a school's specialty with special characteristics. The idea of professional teaching reform has formed distinctive features in talent training [4].

The training goals of our school's safety engineering major are: to meet the needs of socialist economic construction and development, to develop morally, intellectually, and physically, to master the basic theories and methods of safety engineering, to have the concept of safety scientific thinking and safety humanistic care, Basic competence, applied senior professionals who can engage in technical or management work in safety technology and engineering, safety scientific research, safety design and production, safety management and supervision, safety education and training, etc. Combining with the changes in the safety production situation in recent years, the goal is more inclined to achieve the application of advanced innovative talents with a "founded foundation, broad knowledge, strong practical ability, high comprehensive quality, and both morals". Under the premise of safety characteristics and advantages, the safety personnel training for the coal (single) industry should be appropriately expanded, taking into account construction, chemical engineering, and petroleum.

### B. Curriculum

Learning from advanced foreign experience and better domestic safety professional training programs[5], while reflecting the characteristics of our school, the course system of safety engineering major of our school is structured in a "platform + module" manner; the curriculum is set according to the curriculum knowledge structure Courses for three platforms: general education, professional education and comprehensive education platform. General education includes 6 modules including humanities and social sciences, natural science foundation, and economic management. Professional education includes engineering technology foundation, professional foundation, and specialty. The comprehensive education consists of 5 modules, including experimental teaching, comprehensive design, and special ability training. Link composition. The curriculum system adjusts and optimizes the content and credits of a few compulsory (optional) courses, strengthens the organic combination of engineering education and humanities education, and promotes openness and international education.

Students should complete 203.5 total credits upon graduation, including 145.5 credits for theoretical and practical teaching, 48 credits for concentrated practical teaching, and 10 credits for second classroom. When revising the training plan, the approval of the "Safety Engineering Excellent Engineer Training Plan" was used

as an opportunity to improve the curriculum system and practical teaching links with “general standards for the training of undergraduate engineers”:

a) Clarify the teaching content and compulsory credits of the second classroom, so as to incorporate extracurricular scientific and technological innovation activities, subject competitions, academic activities, cultural and sports activities, social practice activities, etc. into the talent training system, so that comprehensive quality education and comprehensive ability training have more reliable guarantee .

b) Further highlighting the characteristics of coal mine safety management, optimizing the content of compulsory (optional) courses, curriculum settings, and course credits, and increasing the number of hours in the experimental link of professional basic courses and professional courses.

c) Public elective modules have been set up. Concentrating the use of advantageous educational resources in various disciplines to set up public elective courses has an important role in satisfying students' learning interests, cultivating a wide range of hobbies, and improving their overall quality.

### C. Training Pathway

#### 1) Optimization and Reform of the Curriculum System

The curriculum system is structured according to the “platform + module” method; the curriculum is set up in accordance with the curriculum knowledge structure into three platform courses: general education, professional education and comprehensive education platform. Combined with the professional education courses offered by the School of Management, students of safety management are offered elective basic courses in management disciplines, laying a professional foundation for interdisciplinary studies. In addition, a course group has been set up in the direction of safety management, and related courses have been conducting seminars to optimize the teaching content of safety management courses.

#### 2) Various teaching methods

In classroom teaching, heuristic, interactive, and case-based teaching methods are used to realize the interaction between teaching and learning, and the close integration of theory and practice, thereby ensuring the continuous improvement of teaching quality. Combining the latest popular MOOC curtain lesson construction and multiple informatization methods, we carry out a variety of online and offline teaching interaction methods, and through the analysis and discussion of the latest accident cases, improve the comprehensive ability of student safety management.

#### 3) R & D teaching

Our school's safety engineering major is one of the nation's most comprehensive and comprehensive levels of personnel training for safety engineering professionals. It has formed a talent training pattern of bachelor of engineering, master of engineering, master of engineering, doctorate, postdoctoral and visiting scholars. Through the

further practice of “researching for scientific research”, the frontiers of science and technology and the latest scientific research gains should be incorporated into the teaching content in teaching; strengthen the effective interaction between teaching and learning in classroom teaching, improve the artistry of teaching, and enhance student initiative and interest in learning. Cultivate students' ability to think, analyze, and solve problems scientifically.

#### 4) Cultivation of high-quality teachers

Cultivate high-quality teachers with certain innovative thinking and rich engineering practice experience. We will use the methods of submission, introduction, sharing, etc. to strengthen the construction of the teaching staff, actively introduce and train top-level well-known academic leaders in academia, and promote the integration of teachers and scientific research practices. Do a good job of “pairing” and “helping the belt” of the professional mentor team, so that the young instructors can improve their political quality, teaching and research capabilities.

#### 5) Strengthen practice to promote students' innovation ability

Formed a “training mode-practical training-science and technology competition” trinity training mode. Our school has improved laboratory conditions in recent years, especially the construction of a safety human factors engineering laboratory and a behavioral safety management experimental center, which provide experimental conditions for behavioral safety management research. In recent years, the safety engineering major has taken the opportunity of professional certification and excellent engineer construction to continuously improve and perfect the safety engineering experimental teaching center. It adopts open management, and various experimental equipment is open to students within 8 hours on weekdays, and is instructed by teachers. The two-week “Enhancement of Safety Engineering Innovation Ability” experiment provided students with enough time to independently use experimental conditions to study and conduct exploratory experiments, meeting the requirements for students to carry out innovative activities. Shaanxi Coal and Chemical Industry Group, Shenhua Shendong Coal Company and other long-term and stable off-campus practice teaching bases have been established. On-campus practice training bases such as engineering training centers have also been continuously built to effectively improve the enthusiasm and participation of students in hands-on practice. In addition, through the “Challenge Cup” college students' extracurricular science and technology works competition, innovation and entrepreneurship competition, safety engineering knowledge competition, safety engineering design competition and other methods, training students' independent thinking and innovative ability.

### V. CONCLUSION

The specialty of safety engineering itself has interdisciplinary nature. As the social needs increasing, it

is urgently to cultivate talents with equal emphasis on safety management and technology for higher safety education. The safety engineering major of XUST has scientifically formulated a talent training plan oriented to major social needs and reformed the talent training model through teaching reforms such as curriculum structure adjustment, teaching content update, teaching method reform, practical teaching innovation, and teacher building. The goal is to have advanced composite technical and management talents who have a solid professional foundation and can adapt to the needs of engineering, with a view to enabling graduates of safety engineering to systematically master the basic theory, technology and methods of safety engineering and occupational safety and health management. Cultivating compound safety management personnel has a positive role to play.

#### CONFLICT OF INTEREST

The authors declare no conflicts of interest to this work.

#### AUTHOR CONTRIBUTIONS

As to contribution, Dr. Li Wang took in charge of the project, Prof. Shuicheng Tian evoked the topic and supported by fund, and Dr. Lianhua Cheng gave practice support, and Dr. Lei Li, doing data analysis.

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