

Discussion on the Construction of "Four in One" Emergency Rescue Courses in Application-Oriented Universities

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Abstract:

With the continuous improvement of China's economic level, especially after the full realization of the great goal of poverty alleviation, people have an increasing demand for safety in work and life. On the basis of sorting out the application research status quo of emergency rescue technology in China, this research aims to explore the foundation for application-oriented universities to offer emergency rescue courses and analyze the education and teaching system for application-oriented universities to offer emergency rescue courses through combining teaching theory with teaching practice. Moreover, this research presents demand-oriented education and "industry-university-research" integrated teaching model to achieve a higher level of safe China as the ultimate goal. To cultivate more high-level emergency rescue technical talents, college education should focus on emergency technical skills training of college graduates as a starting point, and then popularize emergency rescue technology and knowledge in a "point-to-area" manner.

Keywords: *Application-oriented universities; Emergency rescue; Course construction.*

I. INTRODUCTION

General Secretary emphasized at a teacher-student symposium in Peking University in May 2018 that universities should take "formation of a high-level talent training system" as "basic work" [1]. Course construction and personnel training are the basic tasks of colleges and universities. It is the obligatory duty and responsibility of application-oriented colleges and universities to solve practical problems in light of social needs. In view of the low penetration rate of social emergency rescue knowledge, unsystematic emergency decision-making, and non-standard emergency rescue technology, local undergraduate colleges should provide theoretical and technical support for safety emergency management, and cultivate talents with high-level theoretical knowledge and practical application skills of emergency rescue.

II. THE APPLICATION STATUS OF EMERGENCY RESCUE TECHNOLOGY IN CHINA

At present, China has a low domestic popularization rate of emergency rescue knowledge and technology, and emergency training is mainly designed for public welfare. People with a higher accident rate are difficult to receive good training of emergency rescue technology due to their high knowledge level, high job mobility and low willingness to receive training [2]. China has low emergency technology penetration rate, and starts late in systematic research. Nevertheless, as China pays increasing attention in the field of emergency technology, emergency rescue technology research carries important strategic significance for achieving "a higher level of safe China" [3]. For example, for the chemical industry, one of the high-risk industries, some scholars have conducted in-depth research on the status quo of emergency rescue in chemical enterprises and the emergency response system, summarized and analyzed the deficiencies in the accident emergency rescue system of chemical enterprises, and proposed suggestions for improvement [3-4]. Some scholars have also conducted researches on aviation emergency rescue, mine emergency rescue, high-altitude distress accident emergency rescue, etc. [5-7], and analyzed the application and deficiencies of emergency rescue technology in different scenarios. Some researchers have also carried out research on the mechanical equipment used in the emergency rescue process [8], and concluded that there is still greater development potential in the field of emergency machinery manufacturing in China.

In summary, the development of emergency rescue technology in China started late, and there is still plenty of room for improvement. Strengthening the training of personnel with high professional quality of emergency rescue is one of the important means to comprehensively implement the long-term goal of building a higher level of safe China. Local colleges and universities are endowed with responsibility to cultivate application-oriented talents. Implementing the emergency rescue courses in application-oriented universities will be an important means to achieve the multiple goals of cultivating emergency rescue personnel, popularizing emergency rescue knowledge, and enhancing the participation in social security.

III. FOUNDATION FOR APPLICATION-ORIENTED UNIVERSITIES TO OFFER EMERGENCY RESCUE COURSES

As the basic attributes of local application-oriented undergraduate colleges and universities, territoriality, practical application, and service professionalism are important theoretical supports to solve the problems in cultivation of high-level technical talents [9]. The study finds that the current application-oriented colleges and universities have a good foundation for providing emergency rescue related education courses.

3.1 Good education and Teaching Background

Application-oriented colleges and universities take the responsibility and mission of cultivating talents with applied technical skills. This type of colleges and universities has "production-teaching-research" integrated school-running model, which can quickly apply the teaching and research results to social

practice and solve various problems in the current society [9]. In view of the current shortage of emergency rescue technical professionals, the heavy task of popularization and application of technical skills, and the broad application need for social security skills, application-oriented universities can offer such courses to well solve these problems. On one hand, it can increase the popularization rate of emergency rescue technology, so that after entering the society, college students can act as a starting point for the popularization of such technology to cover a certain local community; on the other hand, it also allows students to master more practical technology during school, which increases students' employment opportunities.

3.2 Extensive Social Demand Gap

Emergency rescue is an important survival technique, which has been widely promoted and put in education system abroad. For example, the United States has trained at least 70 million "first witnesses", and the public first aid penetration rate has reached 25%; Sweden has been training the public in first aid knowledge and skills since 1983, and at least 45% of the public have participated in cardiopulmonary resuscitation training; Australia's public training mainly targets at volunteers, and 50% of the public have received relevant training; the popularization rate of first aid knowledge among Japanese middle school students is as high as 92% [10]. However, according to the analysis of statistics from the Ministry of Emergency Management of China, there is a shortage of 430,000 talents in safety supervision, safety services, and safety technology applications across the country in 2020. In the field of emergency and safety management, there are few professionals, unreasonable system structure, difficult introduction and recruitment of talents, insufficient supply of talents and prominent contradiction between supply and demand

3.3 Strong Government Support and Guarantee

Faced with the huge social demand gap, the government advances the training and development of relevant talents through various channels and means. The state has made major reforms and adjustments to the emergency rescue industry. In 2018, the National Emergency Management Bureau was set up. With the firefighting team separated from the military mechanism, and the China Fire and Rescue Institute was established in the same year. The National Vocational Education Alliance in Emergency Safety was organized and established in 2019 mainly to solve the problem of "difficult introduction and retention" of safety technology talents, which unites the strength of the academic community to realize the independent training of safety technology talents. In the same year, the Ministry of Human Resources and Social Security and the Ministry of Emergency Management jointly issued the "National Vocational Skills Standards-Emergency Rescuers". The standard specifies the assessment system and capability requirements for emergency rescuers in detail, which helps encourage aspiring young people in society to engage in emergency rescue work.

IV. SUGGESTIONS ON THE CONSTRUCTION OF THE "FOUR IN ONE" EMERGENCY RESCUE COURSE SYSTEM

Although application-oriented universities have a good foundation for offering the course, a scientific and systematic course construction plan is needed to better offer emergency rescue courses and achieve the expected teaching results. In view of the strong hands-on practice, emphasis on the training of practical hands-on ability in the course, by taking emergency rescue knowledge as the theoretical basis and combining the national emergency rescuer skills requirements standards, we develop an integrated "four in one" course system consisting of special physical training, emergency search and rescue technology, psychological training, on-site first aid skills training, as shown in Figure 1.

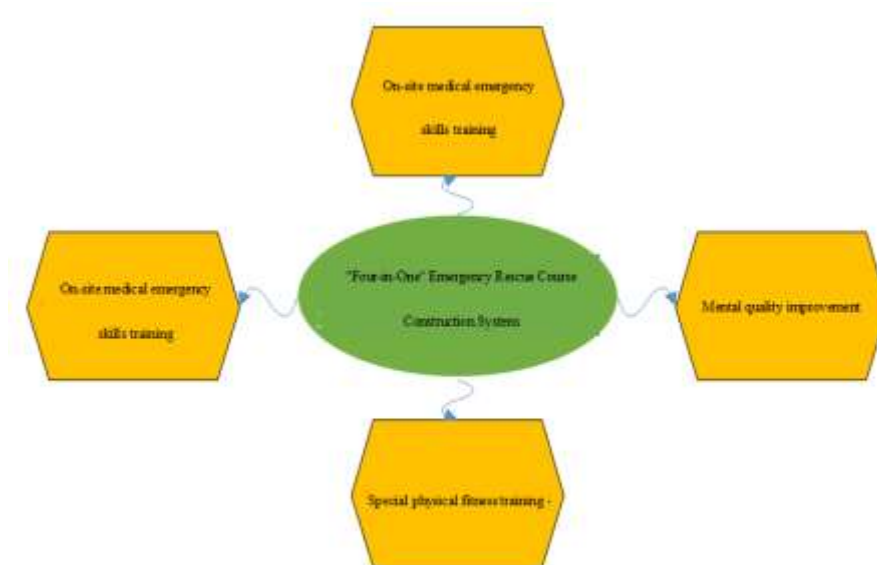


Fig 1: "Four in One" Emergency Rescue Course Construction System

4.1 Special Basic Physical Training

According to the orientation of the emergency rescue course, the course emphasizes the training of students' practical ability, so that students can correctly take emergency rescue measures in emergencies to achieve the goal of controlling the severity of injuries as much as possible. Good physical fitness is the basis for performing emergency rescue missions and also an important prerequisite for ensuring the safety of rescue team members. However, at present, most professional colleges offering emergency-related courses ignore the importance of physical training, or the talent training goals of the colleges and universities fail to fully consider the emergency rescue practice process. Only military colleges and firefighting teams will arrange physical training subjects for students in a targeted manner, which causes a series of problems in popularization and promotion of emergency rescue skills. In order to achieve a wider range of promotion and use of emergency rescue technology and skills, the physical training of students in

application-oriented universities is not only an important prerequisite for the implementation of emergency rescue technology, but also an important step to achieve the goal of comprehensively improving the physical literacy of Chinese young people.

(1) Speed endurance training: Emergency rescue process is often carried out in a complex environment unachievable by vehicles. It requires manpower to carry and transport various rescue materials for search and rescue in a limited time. Therefore, the physical speed endurance of rescuers is a necessary physical condition for the implementation of rescue activities. There are two basic ways to develop speed and endurance quality. One is to improve muscle endurance training. According to the actual situation of the students, it is necessary to formulate tower endurance plan, arrange load training appropriately, carry out multiple sets of exhaustive training, etc.. The other way is to strengthen cardiorespiratory function. According to the actual situation of colleges and universities, training subjects such as swimming, long-distance running, race walking, and rope skipping can be flexibly arranged to meet the speed and endurance requirements in emergency rescue activities.

(2) Strength training: Emergency rescue activities feature uncertainty, complexity, and particularity. For instance, there are search under load, transport of materials and the wounded. Special environments require descending and climbing, transport and operation of heavy rescue equipment, etc. All these demand rescue team members to have strong strength. Based on the actual situation, the legs, torso, shoulders, and upper limbs not only need improve the muscular endurance in an all-round way, but also need appropriate explosive power training to cope with various types of rescue operations.

(3) Coordination training: When carrying out emergency rescue activities, strong physical control capabilities and skilled operations (coordination of people and equipment) are required to support efficient rescue operations. Therefore, the coordination of rescue personnel is the basis for achieving skilled operations. Hence, it is very necessary to carry out corresponding coordination training to help students improve their coordination and physical control ability, so that they improve rescue efficiency in certain specific and complex space environments (such as high altitude, narrow space, severe weather, etc.), and successfully complete the rescue action.

4.2 Special Search and Rescue Technical Training

Emergency search and rescue technical training is one basic skill requirement for completing emergency rescue tasks in outdoor, night and collapse special disaster environment. Corresponding training should be carried out according to the technical skills of emergency rescuers. Students should proficiently master common outdoor search and rescue tools such as maps and compasses, master emergency rescue rope operation technology, on-site emergency rescue system establishment, communication technology, etc. It should be guaranteed that students can receive basic outdoor search and rescue technical skills training.

(1) Special training for personnel positioning and search. In the search and rescue process in sparsely populated areas such as suburbs and virgin forests, it is very likely that there is no reference object around, making it difficult to distinguish the location. Therefore, emergency rescuers need to master personnel positioning technology in an unfamiliar and complex environment. On the one hand, they need figure out where they are and accurately advance to the rescue location; on the other hand, they need to find a quick route to the rescue location based on maps, GPS and other search and rescue tools, thus buying time for rescue.

(2) Rescue rope and equipment operation training. Ropes and portable equipment are one of the most common rescue tools used in various emergency rescue sites, which play a very important role in the personnel rescue process. According to the intermediate technical skills of emergency rescuers, rescuers need to master at least ten types of knotting techniques and understand the characteristics of various rescue equipment in order to correctly use ropes and equipment in rescue activities.

(3) Communication technology training. Emergency rescuers need to keep in touch with the emergency command center and rescuers during the operation, or learn to mark correctly when it is unable to contact the outside world, thereby guiding themselves and giving signals to follow-up rescuers. The students need to master the use of radio, satellite phones and other means to transmit accurate key information on the spot to the outside world, so that the emergency rescue command center can carry out follow-up rescue activities.

(4) Establishment of on-site emergency rescue system. The establishment of on-site emergency rescue system is an important guarantee for the orderly development of emergency rescue activities, which imposes high requirements for the professional quality, rescue experience and knowledge system of personnel. As technical skill requirements for senior workers in the emergency rescuer assessment system, it has high requirements for student ability and serves as an inseparable content for emergency rescue workers to help students establish a complete emergency rescue knowledge system structure.

The assessment weights of emergency rescuers are as follows: Table 1 and Table 2.

Table 1: Theoretical knowledge weights for emergency rescuers in assessment

Project	Skill Level	Level 5/junior worker (%)	Level 4/intermediate worker (%)	Level 3/Senior Engineer (%)	Level 2/Technician (%)	Level 1/Senior Technician (%)
Basic Requirement	Occupation Morals	5	5	5	5	5
	Basic Knowledge	30	15	10	15	20
Relevant Knowledge Requirements	Prevention and Emergency Preparedness	10	10	10	25	30
	Monitoring and	10	10	10	—	—

Early Warning					
Community	20	—	—	—	—
Emergency Rescue					
Building Collapse					
Search and Rescue					
Mountain (rope)					
Rescue					
Hazardous		35	40	45	—
Chemicals	—				
Emergency Rescue					
Mine (tunnel)					
Rescue					
Waters Search and					
Rescue					
Implement Rescue		—	—	—	—
Emergency					
Treatment of the	20	20	15	—	—
wounded					
Rescue the	5	5	10	10	15
aftermath					
Sum	100	100	100	100	100

Table 2: Weights of technical skill requirements in assessment of emergency rescuers

Project	Skill Level	Level 5/junior worker (%)	Level 4/intermediate worker (%)	Level 3/Senior Engineer (%)	Level 2/Technician (%)	Level 1/Senior Technician (%)
			land search and rescue Hazardous Chemicals Emergency Rescue Mine (tunnel) Rescue Waters Search and Rescue	land search and rescue Hazardous Chemicals Emergency Rescue Mine (tunnel) Rescue Waters Search and Rescue	land search and rescue Hazardous Chemicals Emergency Rescue Mine (tunnel) Rescue Waters Search and Rescue	
Skill requirements	Prevention and Emergency Preparedness	15	15	20	25	30
	Monitoring and Early Warning	10	10	10	—	—

Community Emergency Rescue	35			—				—				—			—
Building Collapse															
Search and Rescue	—	30	15	15	—	20	10	10	—	25	15	15	—		—
Mountain (rope) Rescue	—	10	—	—	—	20	—	—	—	30	—	—	—		—
Hazardous Chemicals	—	—	25	—	—	—	30	—	—	—	40	—	—		—
Emergency Rescue															
Mine (tunnel) rescue	—	—	—	25	—	—	—	30	—	—	—	40	—		—
Waters Search and Rescue	—	—	—	—	40	—	—	—	40	—	—	—	55		—
Implement Rescue	—			—				—				—			50
Emergency Treatment of the wounded	30			25				20				—			—
Rescue the aftermath	10			10				10				10			20
Total	100			100				100				100			100

Psychological activities of rescuers are invisible, but carry strategic guiding significance for the success of emergency rescue activities. Only with adequate psychological preparations "before the war" can we ensure a calm and unhurried "wartime" state and accomplish high-level emergency rescue operations. It can be said that psychological training is quite necessary for emergency rescue personnel, but most practitioners exactly lack such training. From various large-scale emergency rescue scenes and the characteristics of various special search and rescue environments, it can be known that search and rescue are often implemented in high-altitude, bloody, cliff, terrified, and nauseous scenes with high irritation [11]. Therefore, personnel engaged in emergency rescue need to understand the basics of psychology in the "pre-war" training, learn how to guide and solve the abnormal psychology in the emergency rescue process, and master the psychological adjustment and control approaches under stress.

(1) Psychological training for emergency rescuers. The main goal of psychological training is to establish a psychological immune mechanism for trainees through training, improve individual psychological protection capabilities, and maximize the effectiveness of rescue work when performing rescue tasks [11]. Colleges and universities need pay attention to the principles of appropriateness and progressiveness in the process of student psychological training for emergency rescue. For example, the height setting should be: ground-low altitude-high altitude (underground), time and environment settings

should be: day-night-complex environment-harsh environment. There is need to take into account the training effectiveness and students' endurance, thus avoiding over-reaction of students.

(2) Psychological comfort of rescued persons. During the rescue, the rescue may not go smoothly, the trapped people may have great psychological ups and downs, showing psychological breakdown, etc., which will cause inconvenience to the rescue operation. Therefore, rescuers must master on-site psychological guidance, incentives and other psychological adjustment methods and ways, so as to comfort the trapped during the rescue process, encourage them to actively cooperate with the rescue, and enhance their survival awareness to achieve the goal of successful rescue.

(3) Psychological counseling training for rescuers after the operation. The scene of each rescue operation has varying severity, making it difficult for rescuers to fully adapt in pre-training. In order to avoid psychological problems (PTSD) of rescuers after rescue activities in extreme terrified scenes, in addition to psychological training in emergency rescue courses, colleges and universities should also let students develop psychological judgment, adjustment and guidance capabilities.

4.4 Emergency Rescue Knowledge Education and On-Site Medical First Aid Skills Training

Colleges and universities should prepare and arrange lessons for common accidents demanding emergency rescue, so that students can master the practical knowledge of emergency rescue scene while understanding basic emergency rescue knowledge. On-site first aid skill training is one of the main components of the course, which is also a direct way for students to master emergency rescue technical skills. Therefore, the practical operation course should teach emergency rescue skills to students as much as possible, to ensure that they have sufficient skills to carry out basic rescue activities during the emergency rescue.

(1) Establishment of emergency rescue knowledge system. Colleges and universities should aim to train emergency rescue professionals with high quality and complete knowledge systems, and build a talent training system. According to the emergency scientific knowledge system proposed by domestic researchers [12], the emergency rescue theoretical knowledge courses of application-oriented universities can be offered from five aspects: emergency science, emergency technology, emergency engineering, emergency industry and emergency management to provide systematic training of emergency rescue knowledge among students.

(2) On-site medical first aid skills training in emergency rescue. Provision of such courses should fully give consideration to local actual conditions, so that by cooperation with communities, hospitals, Red Cross and other institutions, it is possible to jointly build education and training bases for teaching [13], thus training students to stop bleeding, give first aid to burns and scalds, poisoning, provide cardiopulmonary resuscitation and master other commonly used medical first aid operation techniques. On one hand, it can make education and teaching work closer to reality. On the other hand, while

understanding and mastering certain skills, college students can establish a sense of safety, which plays an inestimable role in their future work, life, and helps to achieve social stability.

V. PROSPECTS FOR IMPROVING EMERGENCY RESCUE CAPABILITIES

1. At present, China has a small number of professional emergency rescue personnel. Application-oriented colleges and universities with the ability to cultivate emergency rescue personnel should offer emergency rescue courses to fill up the vacancy of professional emergency rescue technical talents in China as soon as possible.

2. Compared with advanced developed countries, China has a low penetration rate of basic emergency rescue knowledge. After graduation, college students with a comprehensive knowledge system can play a point-to-area role to spread emergency rescue knowledge more professionally and comprehensively to the grassroots community.

3. Through systematic education and teaching in colleges and universities, it is possible to form an emergency rescue system that integrates professional emergency rescue teams and individual emergency rescue, thereby improving the survival rate of injured persons in unexpected accident disasters.

4. With artificial intelligence technology, such as the development of more accurate life detectors, the development of search and rescue robots under harsh conditions, etc., it is possible to increase the success rate of rescue personnel under extremely special and complex conditions while ensuring the safety of search and rescue personnel themselves.

ACKNOWLEDGEMENT

Foundation item: Undergraduate Education and teaching reform research project of Chongqing University of Science and Technology (201981)

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