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Exploration of Methods and Paths for Cultivating Professional Talents in Smart Emergency Response under the Background of Big Data

Lu Chen, En Wang, Jing Zhao, Jingjing Rong

North China Institute of Science and Technology, Beijing, 065201, China

Abstract

The study first expounds the necessity of cultivating professional talents in smart emergency response, then analyzes the current status and existing problems of cultivating such talents. Subsequently, it discusses the methods and paths for cultivating professional talents in smart emergency response under the background of big data from aspects such as the construction of a curriculum system driven by industry characteristics, the integration practice of government, industry, academia and research, and the cross-reinforcement and improvement of teaching staff.

Keywords

Smart Emergency; Big data; Talent cultivation; Interdisciplinary.

1. Introduction

Strengthening the emergency management system and capacity building is not only an urgent task but also a long-term one. This important assertion profoundly reveals the urgency and long-term nature of emergency management work [1]. The urgency stems from the frequent occurrence of various emergencies and the interweaving and superimposition of disaster risks, which pose a direct threat to the safety of people's lives and property and social stability. This requires us to race against time to enhance the speed of emergency response and the efficiency of handling. The long-term nature is reflected in the fact that the improvement of the emergency management system is a systematic project involving multiple dimensions and deep levels such as system optimization, technological innovation, and talent cultivation, which requires persistent advancement. In the current era of big data where the complex and ever-changing technological revolution and industrial transformation are accelerating [2], smart emergency response, as an important support for the modernization of the emergency management system and capacity, is becoming a key force driving the innovative development of the emergency management field [3-4]. It is also an active response to the strategic deployment of strengthening emergency science and technology support and enhancing the intelligent level of emergency management in the "14th Five-Year Plan for the National Emergency Response System" and the "14th Five-Year Plan for the National Comprehensive Disaster Prevention and Mitigation". It is also a need to systematically promote the construction of the national "Smart Emergency Brain" and modern emergency "intelligent" management, and achieve modernization of emergency management. It is also our responsibility to persistently and unremittingly cultivate talents for the emergency management cause [5-6].

The deep integration of cutting-edge technologies such as big data, artificial intelligence, the Internet of Things, and cloud computing [7] has brought unprecedented opportunities to emergency management. However, the vigorous development of smart emergency response has also exposed a significant shortcoming in talent supply, that is, there is an extreme shortage of compound talents who are proficient in both emergency management business and information technology. This has become a bottleneck factor restricting the in-depth

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advancement of smart emergency response construction. Therefore, adding a major in smart emergency response and cultivating emergency information technology talents that can meet the demands of the big data era is an inevitable choice to follow the development trend of The Times and respond to the strategic needs of the country. It is also an inescapable responsibility and mission for educators and emergency management practitioners. We should take this opportunity to deepen educational and teaching reforms and innovate talent cultivation models. Contribute wisdom and strength to building a more scientific, efficient and intelligent emergency management system.

2. The Necessity of Cultivating Professional Talents in Smart Emergency Response

(1) There is an urgent need to address complex disaster risks and challenges and ensure social security and stability

China is one of the countries in the world that suffer the most from natural disasters. The types of disasters are complex and diverse, with a wide geographical distribution and a high frequency of occurrence. The losses caused are also extremely heavy [8-10]. Meanwhile, China's work safety is still at a critical stage of tackling tough problems. Various safety risks and hidden dangers are intertwined and interwoven, and work safety accidents still occur from time to time. The frequent occurrence trend has not been fundamentally reversed. In recent years, the state has attached great importance to emergency management work. In July 2018, when the Ministry of Emergency Management was first established, it explicitly stated that "without informatization, there would be no modernization of emergency management", and required that the construction of informatization be closely integrated with the reform and development of the emergency management cause and advanced in an integrated manner, using informatization as the engine to drive the emergency management cause to a new height. The "Opinions on Promoting the Informatization Construction of Emergency Management" issued by the Ministry of Emergency Management in 2021 clearly states that we should adhere to promoting the modernization of emergency management through informatization, strengthen the practical orientation and the traction of "smart emergency response", consolidate the foundation for informatization development, and make up for the shortcomings and weak points in aspects such as networks, data, security and standards. Promote the formation of a complete, well-structured and technologically advanced emergency management information system, and comprehensively enhance the capabilities of monitoring and early warning, regulatory law enforcement, auxiliary command and decision-making, rescue operations and social mobilization. The "14th Five-Year Plan for the National Emergency Response System" proposes that by 2035, a major country emergency response system with Chinese characteristics that is in line with the basic realization of modernization should be established, fully realizing emergency response in accordance with the law, scientifically and intelligently, forming a new pattern of emergency management featuring joint construction, joint governance and shared benefits, and formulating application standards for new technologies such as big data, the Internet of Things and artificial intelligence in the field of emergency management. Strengthen the sharing of resources, information exchange and joint training and practice among various rescue forces. The "Special Plan for Scientific and Technological Innovation in Public Security and Disaster Prevention and Mitigation during the 14th Five-Year Plan Period" also points out that it is necessary to strengthen the innovative application of digital technologies such as cloud computing, big data, the Internet of Things, industrial Internet, and artificial intelligence in the research and development of technologies and equipment for monitoring and early warning of major disasters and accidents and emergency rescue.

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In order to keep up with the trend of The Times and meet the urgent needs of the national emergency management system and capacity building, a new major in smart emergency response has been added. The aim is to cultivate a group of compound, innovative and applied smart emergency response talents who are not only proficient in emergency management business knowledge but also skilled in modern information technologies such as big data, artificial intelligence and the Internet of Things. It has become an inevitable choice for building a major country emergency response system with Chinese characteristics and fully realizing emergency response in accordance with the law, scientifically and intelligently.

(2) A key support for promoting the digital transformation of emergency management and enhancing emergency response efficiency

With the steady progress of China's emergency management cause, the emergency management system has been increasingly improved, and a considerable and dynamic emergency industry has gradually been established. Against this backdrop, the demand for emergency management talents from government agencies at all levels and enterprises and public institutions has shown explosive growth, especially for professionals in smart emergency response, which is even more urgent. From the perspective of policy orientation, a series of important plans have pointed out the direction for the cultivation of smart emergency response talents. The "14th Five-Year Plan for the National Emergency Management System" clearly stipulates that during the "14th Five-Year Plan" period, the proportion of professional talents in emergency management departments at or above the county level should reach a hard target of 60%. To achieve this goal, the plan requires the establishment of a list of professional talents in emergency management, precise sorting out of talent demands, and expansion of channels for the cultivation and supply of urgently needed and scarce talents. At the same time, it is emphasized that the discipline and professional system construction of emergency management should be strengthened. Universities are encouraged to actively set up emergency management-related majors, with a focus on cultivating comprehensive, compound, innovative, applied and skilled emergency management talents, so as to reserve a solid talent force for the emergency management cause. However, the current situation of supply and demand for talents is not optimistic. According to China Science News, the current talent shortage in China's emergency management system is as high as about 400,000, and the shortage of emergency management talents in the industrial, mining and commercial and trade sectors has reached about 2 million. The shortage of general talents needed in the entire emergency industry chain has exceeded 10 million. Among this huge talent gap, interdisciplinary professionals in smart emergency management who master modern information technologies such as big data, artificial intelligence and the Internet of Things, and are proficient in the knowledge of emergency management are particularly scarce, becoming a key bottleneck restricting the development of the emergency management industry.

Therefore, in the face of the challenges in the emergency management field and economic and social development, enhancing the intelligent and precise monitoring, accurate early warning, efficient rescue and precise command of various risks and hidden dangers, and cultivating professional talents in smart emergency response, can meet the urgent social demand for the modernization and professionalization of emergency management. It is an inevitable choice to precisely cultivate and supply compound and applied smart emergency management professionals who master advanced modern information technologies such as big data, artificial intelligence and the Internet of Things, as well as emergency management knowledge, for the safe operation of cities, the safe production of enterprises and the stable development of society.

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3. The Current Situation and Existing Problems of Professional Talent Cultivation in Smart Emergency Response

(1) The current situation of professional talent construction in smart emergency response

In recent years, the state has accelerated the construction of the discipline of smart emergency response through policy guidance and vigorously promoted the cultivation of smart emergency response talents. Since The State Council's Academic Degrees Committee issued a notice in 2020 to establish the second-level discipline of emergency Management under the first-level discipline of public administration, the discipline construction of emergency management has achieved leapfrog development. In 2025, the Ministry of Education further included smart emergency response in the undergraduate major directory, promoting the establishment of related majors at the China Institute of Disaster Prevention Science and Technology, making it the first higher education institution in the country to set up a smart emergency response undergraduate major. At the same time, North China Institute of Science and Technology is also vigorously developing the direction of emergency informatization to contribute to the development of the smart emergency response major and the cultivation of talents. The talent sources of emergency management units affiliated to governments at all levels mainly rely on the training of emergency management majors in various colleges and universities, and in the later stage, their emergency management capabilities are improved through various professional trainings.

At the Emergency Management University (in preparation), one of the distinctive places for cultivating emergency management talents, the university, in line with the development of China's emergency management cause and the economy and society, as well as the construction orientation of the Ministry of Education to create new engineering disciplines, cultivate cross-disciplinary and emerging specialties, and train practical talents in urgently needed fields in an unconventional way, By setting up courses such as data mining technology, emergency plan formulation and drills, and intelligent emergency decision-making and rescue technology for interdisciplinary integrated teaching, China's first new major with intelligent emergency characteristics and cross-integration has been established. This move marks that the cultivation of intelligent emergency talents has entered a systematic stage, laying a solid foundation for the training of specialized intelligent emergency talents. Continuously supply professional talents in intelligent emergency response to the emergency field.

(2) Problems existing in the cultivation of professional talents in intelligent emergency response

Before 2023, "Smart Emergency Response" was not included in the "Directory of Undergraduate Programs in Regular Institutions of Higher Learning". Most universities only had it as a research direction under the first-level discipline of "Emergency Technology and Management", and the curriculum setting lacked authoritative standards. However, the Smart Emergency Response major was first established at the Disaster Prevention and Mitigation Science and Technology College in 2025. As the first institution to offer this major, It not only marks a breakthrough in the professionalization of smart emergency response, but also indicates that the construction of the professional curriculum system still faces the challenge of "exploring from scratch".

Due to the differences in the nature of the institutions, the focus of each university in cultivating talents for the emergency management system also varies. For instance, comprehensive universities, leveraging their interdisciplinary advantages, often emphasize the macro construction of the theoretical system of emergency management and interdisciplinary research, aiming to cultivate students' understanding of the social value and policy orientation of emergency management from a macro perspective. However, the imparting of practical skills in emergency management and cutting-edge technologies in the industry is relatively weak.

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While science and engineering colleges rely on a strong foundation in engineering and technology disciplines, they focus on application fields such as disaster monitoring technology, emergency equipment research and development, and information system construction. However, they have obvious shortcomings in the cultivation of soft skills such as emergency management laws and regulations, crisis communication, and psychological intervention, as shown in Table 1. This kind of course differentiation caused by the differences in the nature of institutions of higher learning leads to significant differences in the knowledge structure and ability quality of smart emergency professionals cultivated by different institutions, making it difficult to form a unified talent quality standard.

Table 1. Statistics of core courses for the emergency technology and management major

Nature of the institution	Typical representative institutions	The core curriculum setting of the discipline of Emergency Technology and Management	Advantages	Disadvantages
Comprehensive colleges and universities	Tsinghua University	«Introduction to Emergency Management», «Emergency management methods and techniques», «Public Crisis Management», «Conflict Management»	Focus on a macro understanding of the social value and policy orientation of emergency management	Lack of emergency practical skills training
Science and engineering colleges	China University of Mining and Technology (Beijing)	«Management Information System», «Fundamentals of Operations Research», «Emergency Operations Management», «System Analysis and Coordination»	Focus on the application and research and development of emergency technologies	The soft science content such as emergency management policies and laws and regulations is weak
Liberal arts colleges	Renmin University of China	«Research on Emergency Management», «Research Methods in Management Science», «Chinese Government Management and Innovation»	Focus on the formulation of emergency policies and management theories	The practical technical courses offered are insufficient
Industry-oriented colleges and universities	Disaster Prevention Science and Technology College, North China Institute of Science and Technology	«Introduction to Emergency Management», «Emergency Decision-making and Command», «Compilation and Drill of Emergency Plans», «Disaster Science»	Focus on vertical fields such as mining, safety, and earthquake	The coverage of cross-disciplinary and cross-industry intelligent technologies is limited

In addition, a national sharing mechanism for resources such as teaching materials and practical training platforms has not yet been established. Moreover, the teaching staff must possess both emergency scene experience and information technology capabilities, making it difficult to meet the demands in the short term. In the face of the interdisciplinary background of cultivating professional talents in smart emergency response, clarifying the internal logical connections and connections among courses of various disciplines, deepening the degree of course integration, rationally implementing practical teaching links, and combining with the real demands of the emergency field remain the directions that need to be urgently explored and deeply cultivated in the process of cultivating professional talents in smart emergency response in China.

Therefore, for the cultivation of professional talents in smart emergency response, it should be advanced in a coordinated manner from multiple dimensions such as the construction of the curriculum system, cross-disciplinary integration, the establishment of practical platforms, and the optimization of the teaching staff. This will systematically address issues such as the fragmentation of the curriculum system, cross-disciplinary barriers, and the disconnection in practice in the cultivation of smart emergency response talents. Comprehensively enhancing

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the overall quality of professionals in smart emergency response provides a solid talent support for building a "comprehensive disaster type and large-scale emergency response" system.

4. Methods and Paths for Cultivating Professional Talents in Smart Emergency Response

In light of the current situation of talent cultivation in the field of smart emergency response, it is urgent to make precise efforts in three aspects: building a curriculum system driven by industry characteristics, integrating government, industry, academia and research in practice, and strengthening and enhancing cross-disciplinary teaching staff. This is to address the pain points existing in current talent cultivation, such as technical disconnection, insufficient practice, and weak teaching staff, and break through the barriers of traditional disciplines. Build a three-spiral integrated curriculum system of "disaster mechanism - intelligent technology - emergency management" to provide professional talent support for smart emergency management in the field of emergency management.

(1) Industry-specific drive process system construction: Consolidating the foundation for cultivating smart emergency response talents

As an emerging interdisciplinary subject under the "all-disaster, large-scale emergency" system, smart emergency response takes industry characteristics as the core orientation of talent cultivation. It is required that its curriculum system must break away from the traditional disciplinary framework, take industry demands as the orientation, disaster scenarios as the driving force, and technology applications as the support, and build a deeply integrated and characteristic curriculum system across disciplines. To address the core issues such as the fragmentation of current courses and the disconnection between theory and practice, lay a solid foundation for the cultivation of professional talents in smart emergency response, and enable students to accurately master the knowledge and skills required in the field of emergency management.

In terms of the curriculum design of the Smart Emergency Response major, based on the development process of China's emergency management cause and economic and social development, a new interdisciplinary emerging major integrating new engineering is constructed in the emergency field to cultivate extraordinary practical emergency response talents. Integrate core courses such as emergency management, Emergency Plan formulation and drills, emergency Decision-making and Rescue Technology, Emergency supervision and law enforcement technology, emergency communication and information Technology, Design and Development of Smart Emergency Systems, and Internet of Things Technology and Application, strengthen students' interdisciplinary knowledge structure, and enable students to have a framework of an emergency management system Learning to use various disaster emergency monitoring and early warning technologies can enable timely assessment of emergencies, and mastering corresponding computer science and technology such as the Internet of Things, cloud computing and artificial intelligence to analyze and assist in forming emergency decisions, providing theoretical support and technical guidance for the cultivation of professional talents in smart emergency response.

The cultivation of professional talents in smart emergency response should attach great importance to the construction of practical teaching platforms, and build a five-in-one practical teaching platform of "basic laboratory - professional laboratory - virtual simulation laboratory - smart teaching platform - training platform". Build a basic laboratory led by computer technology to meet students' basic experimental needs such as programming and software development. Build a professional laboratory for simulating smart emergency response systems, simulating emergencies in various disaster scenarios, and equip it with advanced monitoring devices to conduct experiments on disaster data collection and early warning. In

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the virtual simulation laboratory, virtual reality technology is utilized to construct virtual emergency scenarios, enabling students to conduct emergency drills and operational practices in an immersive way and enhancing their ability to handle complex situations. Build a "one platform and three terminals" smart teaching platform to achieve real-time data collection, cloud analysis and processing, and immediate result feedback throughout the entire process of "online + offline" teaching. By connecting the practical training platform with the work processes of safety management, safety inspection, disaster prevention and control, etc., virtual simulation practical training resources are built and developed to create a virtual simulation practical training center for safety emergency response. Help students grow into compound emergency talents who "understand technology, are capable of management and have practical experience".

(2) Integration practice of government, industry, academia and research: Building a practical bridge for the cultivation of smart emergency response talents

The cultivation of professional talents in smart emergency response requires the full integration of resources from multiple aspects such as the government, enterprises and institutions, and research institutes, to build a comprehensive and multi-level cooperation system among government, industry, academia and research, and to build a solid bridge for students to reach the front line of practice. By breaking down industry barriers and deepening collaborative innovation, we have deeply integrated theoretical teaching with industry practice, effectively enhancing students' emergency response capabilities and technical application levels.

In terms of the cooperation model, we actively invite experts in the emergency management field to enter the classroom, integrating the latest developments and practical experience in emergency management into the teaching content. Through the second classroom, organize practical activities such as emergency drills and technical discussions to broaden students' horizons. Meanwhile, relying on on-the-job internships, graduation internships and other links, students are enabled to go deep into the front line of emergency management and hone their professional skills in real scenarios. In terms of project cooperation, we actively carry out extensive and in-depth cooperation with government departments and research institutes. From policy formulation to technology application, we explore new paths for disaster prevention and control in multiple dimensions, and delve deeply into areas such as emergency rescue worker training and vocational skills textbook compilation, providing standards and support for the industry to cultivate professional talents. In terms of base construction, we actively establish cooperative relationships or practical teaching bases with enterprises and public institutions, covering practical bases of different types of emergency management. We not only provide internship positions for students but also deeply cooperate with schools in aspects such as technology research and development and talent cultivation, jointly providing good conditions and support for the cultivation of smart emergency management talents. Through the deep integration of government, industry, academia and research, a new talent cultivation model of "combining learning with application and collaborative innovation" has been gradually established, laying a solid foundation for cultivating innovative, compound and applied smart emergency response talents.

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(3) Cross-reinforcement and enhancement of teaching staff: Activating the core driving force for cultivating smart emergency response talents

The traditional teaching staff with a single-discipline background is difficult to meet the demands of cultivating compound talents. The cross-reinforcement and improvement of teaching staff have become the key methods and paths to activate the core driving force of cultivating smart emergency response talents. At present, the Smart Emergency response major integrates knowledge from multiple disciplines such as information technology, disaster science, management, and psychology. If the background of the teaching staff is limited to a single discipline, it is easy to cause students' knowledge structure to be biased, making it difficult for them to deal with complex and changeable emergencies. For instance, when dealing with major geological disasters, it is not only necessary to possess knowledge of geography, meteorology and other fields to predict disasters, but also to apply artificial intelligence technologies such as big data and geographic information systems for disaster monitoring and in-depth analysis. At the same time, management knowledge is relied upon for resource allocation and command decision-making. Therefore, cross-reinforcement of teaching staff is extremely urgent.

In response to the difficulties faced in the construction of the teaching staff for the smart emergency response major mentioned above, it is urgently necessary to break down the barriers between colleges and disciplines, integrate teaching forces with backgrounds in emergency management, emergency technology, data science and big data technology, disaster prevention and mitigation science and engineering, etc., and introduce practical experts from government emergency departments, enterprise technical teams, rescue institutions, etc. as part-time mentors to strengthen the combination of theory and practice. Build a joint teaching team with solid basic theories and rich practical experience. For instance, in the Smart Emergency Command course, the big data technology teacher is responsible for explaining the technical principles of the intelligent command system, while the emergency management teacher focuses on the command decision-making process and resource allocation strategies. This enables students to acquire knowledge from multiple disciplines in one course and enhance their comprehensive application abilities. In addition, teachers are encouraged to participate in interdisciplinary academic exchange activities, training programs and scientific research cooperation. By conducting specialized training on smart emergency response and participating in academic conferences and training courses, teachers can come into contact with the cutting-edge theories and practical achievements of different disciplines and integrate them into their teaching. Encourage teachers to collaborate in developing courses in a "modular" manner (such as "Smart City Resilience Construction" and "Emergency Public Opinion Big Data Analysis"), and carry out industry-university-research cooperation with emergency management departments and enterprises. This enables teachers to go deep into

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the front line of emergency management, understand actual needs, enrich teaching cases, and enhance the practicality and pertinence of teaching.

By strengthening the cross-disciplinary teaching staff to address the pain point of the smart emergency response teaching team where "those who understand technology do not understand emergency response, and those who understand emergency response do not understand technology", it can effectively cultivate smart emergency response professionals with cross-disciplinary knowledge and skills. These talents can flexibly apply multi-disciplinary knowledge in emergency management, quickly and accurately analyze problems and formulate solutions, thereby enhancing the efficiency and scientific nature of emergency management.

5. Conclusions

Against the backdrop of the rapid development of big data technology, the cultivation of professional talents in smart emergency response is a comprehensive consideration based on the digital transformation trend of the emergency management industry, the market's demand for compound talents, and the need for upgrading professional qualities, which conforms to the strategic needs of the modernization of national emergency management. This paper's research indicates that in the era of big data, the cultivation of smart emergency response talents urgently needs to incorporate concepts such as data-driven and interdisciplinary integration, promoting a talent cultivation path centered on the reconstruction of industry-driven curriculum systems, the establishment of practical platforms for government, industry, academia, and research, and the cross-reinforcement of teaching staff. This approach is forward-looking, scientific, and feasible, and can effectively consolidate the quality of professional education at the undergraduate level.

These innovative training methods and paths not only reserve solid data processing and intelligent decision-making capabilities for smart emergency response talents, but also provide strong talent support and intellectual guarantee for the digital and intelligent development and construction of the national emergency management system. Meanwhile, this training model also provides a referenceable idea for the talent cultivation of related majors in other universities in the era of big data. It has significant demonstration value for promoting similar institutions to optimize their talent cultivation plans and adapt to industry changes, and helps to promote the wide application and in-depth development of big data technology in the field of smart emergency talent cultivation. The innovative methods and paths for cultivating professional talents in smart emergency response under the background of big data have provided high-quality talents that meet the demands of The Times for China's emergency management cause, and also opened up a new direction for the improvement of the talent cultivation system in smart emergency response.

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