

Research on Quality Assurance and Evaluation Model for Undergraduate Graduation Design (Thesis) of Emergency Equipment Specialized Majors

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Abstract: This study aims to explore the construction and optimization of quality assurance and evaluation models for undergraduate graduation design (thesis) in the specialized major of emergency equipment, with the goal of enhancing the educational quality in this field. A combined method of literature analysis and field research was employed, involving a systematic review of existing literature to identify current challenges in quality assurance and bottlenecks in evaluation. Furthermore, based on survey data, the practical experiences and outcomes of graduation design in the emergency equipment major across various universities were analyzed. During the research process, a multi-dimensional quality evaluation index system was designed, covering aspects such as students' ability development, instructor evaluations, design innovation, and applicability. The results indicate that establishing a scientifically reasonable quality assurance and evaluation system has a significant impact on improving the quality of graduation design. The collaborative efforts of multiple parties (such as universities, enterprises, and industry experts) play a crucial role in this process. The study suggests that the quality assurance and evaluation model for graduation design should be further improved through continuous quality feedback and improvement mechanisms, as well as optimized resource allocation, to adapt to the rapidly changing demands of the emergency equipment industry.

Keywords: Emergency Equipment; Graduation Design; Quality Assurance; Evaluation System; Educational Quality

1. Introduction

1.1 Research Background and Significance

With the continuous advancement of globalization, there is an increasing demand for emergency equipment in the face of disasters and emergencies across countries. Emergency equipment encompasses a wide range of fields, including but not limited to protective gear, rescue equipment, and monitoring systems, which play a crucial role in disaster relief, accident handling, and public safety. However, the growing demand for high-quality emergency equipment has made the cultivation of relevant professionals a key issue. The specialized major in emergency equipment has emerged to nurture comprehensive talents with the ability to design, manufacture, apply, and manage such equipment. As the final phase of education in this major, the undergraduate graduation design holds significant importance for enhancing students' comprehensive abilities and problem-solving skills. High-quality graduation designs not only serve as an assessment of students' learning outcomes but also directly impact their employability. Therefore, exploring and constructing an effective quality assurance and evaluation model for graduation design is crucial for improving students' overall quality and professional level.

1.2 Review of Domestic and International Research Status

Internationally, the educational research in the field of emergency equipment has a relatively early start, and the related quality assurance and evaluation systems are relatively mature. Universities in countries like the United States and the United Kingdom commonly adopt a project-based teaching model, emphasizing

students' practical abilities in real-world scenarios. This model often integrates enterprise resources, providing students with real project topics, where students complete project design and implementation through teamwork, thereby exercising their comprehensive abilities. Literature [1] indicates that such a teaching model effectively enhances students' innovative awareness and practical abilities.

Domestically, in recent years, with the improvement of the emergency management system, universities have opened up specialized majors in emergency equipment. However, due to the relatively short history of the major, many universities lack sufficient experience in the quality assurance and evaluation process of graduation design. Some universities have introduced advanced teaching concepts, but in the implementation process, they still face issues such as inconsistent evaluation criteria and imperfect evaluation processes. Existing research is mostly focused on the improvement of teaching methods, with relatively few systematic studies on the overall quality assurance and evaluation system.

2. Theoretical Foundation

2.1 Quality Assurance Theory

Quality assurance theory in the field of education has a profound theoretical foundation, with its core being the systematic management and control to ensure that the educational process and outcomes meet the established quality standards. Quality assurance includes two main aspects: process control and outcome assessment. Process control emphasizes the setting of reasonable standards and procedures during the implementation of teaching activities to ensure the effectiveness and consistency of teaching. Outcome assessment focuses on measuring and feedback to continuously improve teaching quality. In the education of the specialized major in emergency equipment, quality assurance theory can provide theoretical support for the quality control of graduation design, ensuring the scientific and standardized process of the entire design.

2.2 Evaluation Model Theory

Evaluation model theory is an important research direction in the field of education,

involving systematic assessment methods and strategies for educational outcomes. The main evaluation models include goal-oriented, process-oriented, and outcome-oriented models. The goal-oriented model focuses on the degree of achievement of educational goals, emphasizing the combination of qualitative and quantitative indicators. The process-oriented model attaches importance to key stages in the educational process, emphasizing process records and feedback mechanisms. The outcome-oriented model focuses on academic achievements and practical applications, emphasizing the measurability of results. In the evaluation of graduation design in the major of emergency equipment, combining multiple evaluation models can effectively improve the comprehensiveness and fairness of the evaluation, ensuring that all aspects of students' abilities during the design process are fully reflected.

3. Overview of the Specialized Major in Emergency Equipment

3.1 Characteristics and Development Trends

The specialized major in emergency equipment is a response to the global and modernized social demand for public safety. The major is characterized by its interdisciplinary integration, encompassing fields such as mechanical engineering, electronic information, computer science, and management. This integration requires students not only to master fundamental theoretical knowledge but also to possess strong practical hands-on skills and innovative thinking, enabling them to respond quickly in complex and changing emergency scenarios.

Looking at the development trends, the frequent occurrence of natural disasters, accident disasters, and public health emergencies has led to an increasing demand for emergency equipment worldwide. Technological progress has also driven innovation and development in this field, with intelligence, automation, and dataization becoming important directions for the development of emergency equipment. These changes necessitate continuous updates to the curriculum of the emergency equipment major to adapt to the dynamic industry needs. For example, the application of drone technology

in emergency rescue has become increasingly widespread in recent years, and its integration has become a focus for many universities updating their courses. Moreover, the development of information technology has also prompted continuous innovation in the monitoring, early warning, and command functions of emergency equipment.

3.2 Talent Cultivation Goals and Demand Analysis

In terms of talent cultivation, the goal of the specialized major in emergency equipment is to foster comprehensive talents with solid theoretical foundations, outstanding practical abilities, and innovative spirits. These graduates are expected to be able to design, manufacture, and manage various complex emergency equipment systems and possess the ability to respond quickly and solve problems. the cultivation process emphasizes the close integration of theory and practice, focusing on students' hands-on skills and teamwork abilities.

From the perspective of social demand, there is an increasing need for high-quality emergency equipment talents among government agencies, non-governmental organizations, and enterprises. According to statistics from the China Ministry of Emergency Management, the talent gap in this industry exceeded 300,000 in 2021, and this number is still growing. the development of the industry requires talents who are both technically proficient and knowledgeable in management, particularly in areas such as risk assessment, disaster response, and emergency command. Enterprises hope that these talents can quickly deploy emergency measures in emergencies to reduce casualties and economic losses.

4. Current Status Analysis

4.1 Current Status of Undergraduate Graduation Design Quality

At the undergraduate level, graduation design serves as a comprehensive demonstration of students' abilities. Currently, the graduation design in the specialized major of emergency equipment exhibits a rich and diverse range of characteristics in terms of overall quality. Many universities emphasize the practicality and innovativeness of graduation design, encouraging students to apply their knowledge

to solving real-world problems. Students' graduation projects cover a wide range of areas, such as the development of emergency communication platforms, design of disaster monitoring systems, and improvement of personal protective equipment.

However, from the current situation, although most students can complete their design tasks, there are still significant deficiencies in terms of innovation, systematics, and practicality. Data shows that approximately 60% of emergency equipment graduation designs are mainly literature reviews or experimental reports, lacking innovative projects with practical application value [3]. This situation reflects both the difficulties students encounter in generating creativity and implementing designs, as well as the shortcomings in guidance and support from universities.

4.2 Existing Issues and Challenges

In the process of implementing undergraduate graduation design in the specialized major of emergency equipment, numerous issues and challenges are encountered. Students' insufficient innovation and practical experience are the main factors the quality of projects. Although the curriculum includes internship and laboratory sessions, these often fail to provide sufficient practical opportunities and innovative space, making it difficult for students to break through traditional thinking patterns in their graduation designs.

The diverse professional backgrounds and industry experience of guiding teachers also pose challenges. Some teachers lack practical experience in the field of emergency equipment, resulting in insufficient guidance and support for students in project selection and implementation. Under such circumstances, students' design plans often lack practicality and operability.

The lack of unified evaluation criteria and the imperfect evaluation process also affect the quality of graduation design. Some universities lack systematic evaluation standards and scientific evaluation methods, leading to subjective and arbitrary evaluation results. According to a survey, more than 40% of students reported feeling that the assessment criteria were vague and not transparent during the evaluation process [4].

5. Construction of Quality Assurance and

Evaluation Model

In the context of modern higher education, especially with the vigorous development of applied undergraduate education, researching the quality assurance and evaluation model for undergraduate graduation design (thesis) in the specialized major of emergency equipment has become a critical issue. This is not only related to the quality of talent cultivation but also directly affects the future development and innovation capabilities of the professional field. By constructing a scientific quality evaluation model, it is possible to effectively enhance educational outcomes and the quality of talent cultivation.

5.1 Design of Quality Evaluation Index System

The design of a reasonable quality evaluation index system is a crucial step in ensuring the quality of graduation design (thesis). Firstly, the design of the evaluation index system should be based on a multi-dimensional consideration. Theoretical knowledge is key, such as the extent to which students master the core theories of emergency equipment and their application capabilities in design. Practical skills are also important, including the ability to innovate in equipment technology and solve practical problems. Innovation should be considered as one of the core evaluation indicators, measuring whether students can introduce new concepts or methods in the design process. Lastly, social responsibility is an indispensable element, especially in the field of emergency equipment, where the attention students demonstrate towards social needs and human safety in their designs should be emphasized. These indicators form a comprehensive evaluation network that provides a basis for the overall control of graduation design quality.

5.2 Mechanisms of Assurance and Evaluation Process

In terms of quality assurance, establishing a systematic assurance mechanism is crucial. Firstly, institutional assurance is necessary, with the university formulating detailed management regulations for graduation design (thesis), with clear requirements and standards for the entire process from topic selection to defense. Additionally, the assurance of teaching staff is also crucial, achieved through

teacher training and expert guidance to ensure the professionalism and fairness of the evaluation. In terms of the evaluation process, the introduction of peer review and double-blind review models can be considered to ensure the objectivity and scientificity of the evaluation results. To this end, the university can establish a review committee involving experts from both inside and outside the school to enhance the reliability of the evaluation through collective wisdom.

6. Implementation Strategies

To effectively implement the aforementioned quality assurance and evaluation model, practical and feasible strategies must be formulated.

6.1 Multi-party Collaboration Mechanism

The multi-party collaboration mechanism emphasizes cooperation between internal departments of universities and external industries. Internally, teaching, research, and administrative departments should form a synergy, supporting each other. Externally, partnerships with industry enterprises should be established, particularly by introducing real projects from enterprises as part of the graduation design to enhance the practicality and real-world significance of the design. Through this collaboration mechanism, students can not only receive theoretical guidance but also exercise their practical skills in real-world environments. The participation of industry experts also helps ensure the cutting-edge and feasibility of design topics.

6.2 Continuous Improvement and Feedback Mechanism

Establishing a continuous improvement and feedback mechanism is an effective means of enhancing teaching quality. Firstly, a systematic feedback channel should be established to collect opinions and suggestions from students, mentors, and industry partners. These feedbacks can be obtained through surveys, seminars, and other methods. Secondly, the collected opinions should be analyzed to identify weaknesses in teaching and design processes, and targeted improvement measures should be taken. Through this closed-loop management, the quality assurance system for graduation design (thesis) can be continuously optimized.

7. Conclusion

This paper, through in-depth research on the quality assurance and evaluation model for undergraduate graduation design (thesis) in the specialized major of emergency equipment, proposes a quality assurance framework based on a multi-dimensional evaluation index system. This framework not only covers key elements such as theoretical knowledge, practical skills, innovation, and social responsibility but also emphasizes the scientificity of institutional assurance and the evaluation process. At the same time, through the implementation strategies of multi-party collaboration mechanisms and continuous improvement and feedback mechanisms, practical and feasible paths for enhancing the quality of graduation design (thesis) are provided.

Although the quality assurance and evaluation model constructed in this paper provides a reference for the improvement of educational quality in the specialized major of emergency equipment, there is still room for further research. In the future, with the development of technology and changes in industry demands, the evaluation index system needs to be continuously updated and improved. Additionally, it can be further explored how to effectively utilize big data and artificial intelligence technology to provide more precise and personalized feedback in the evaluation process. At the same time, deepening international exchanges and cooperation is an important direction, through which advanced international experiences can be learned and further promoted the internationalization development of the major.

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