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Research and Practice on the Innovative Mode of Practical Teaching of Civil Aviation Engineering under the Background of "Professional Certification + Emerging Engineering Education"

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Abstract: This paper mainly studies the practical teaching mode under the background of Professional Certification and Emerging Engineering Education. Based on the analysis of the problems faced by the practical teaching mode of civil aviation colleges and universities at the present stage, the construction objectives are proposed in combination with the specific construction contents, and the construction of the practical teaching system and methods are further proposed: first, the "one body and two wings" structure of experimental practical teaching and the multi-level experimental curriculum system are constructed; Secondly, innovate the "multi subject multi approach multi stage" experimental practice teaching mode based on industry university cooperation, collaborative education, practice and training, and mass entrepreneurship and innovation education; Thirdly, based on the "diversified" assessment, the evaluation method of students' learning effect should be reconstructed; Finally, integrate experimental teaching resources, strengthen school enterprise cooperation and practical training education, and promote the school enterprise collaborative training mode. This study is of great significance for improving the quality of civil aviation professional training, and provides some reference for innovative practice teaching of other engineering majors.

Keywords: Engineering education; Practical teaching system; Curriculum system; Teaching mode; Cooperative education.

1. Introduction

Since China officially became a member of the Washington Agreement in 2016, the professional certification scope of China Engineering Education Certification Association has covered 21 major categories, including machinery, materials, electrical, electronic information, transportation, safety science and engineering, and will achieve full coverage of all professional categories, including aerospace. In 2017, the Ministry of Education of China proposed the construction of new engineering courses as a new strategy for the country to promote higher education reform in the new era.

As colleges and universities continue to deepen the education reform of engineering talents, the training quality of engineering and technical talents is constantly improving. However, for the air transport industry, there is a certain gap between the quality of its talents and the requirements of the upgrading of the aviation industry and the technological development of enterprises for talents. Engineering education needs to be further improved, and there are deficiencies in the training of knowledge and practical abilities of engineering students [1-2].

At present, there are still some problems in the cultivation of civil aviation talents in China, such as insufficient connection between theoretical knowledge and practical ability, weak subjective initiative of students in independent research and active exploration, single practice content, lack of integration with practical engineering problems, weak engineering innovation practice ability, large gap between graduates' engineering practice ability and enterprise development requirements, etc. How to deepen the reform of civil aviation professional education, improve the quality of talent education, and adapt to the needs of industry development has become an important bottleneck for the healthy and rapid development of the civil aviation industry in our province and even our country. At present, the Ministry of Education is strengthening the construction of new engineering disciplines, and professional certification is also in full swing. Both of them emphasize the practicality of discipline construction, cross integration and innovation, which reflects the demand of the new round of scientific and technological industrial revolution for the quality of talent training [3-6].

2. Current situation and problems

2.1. Contradiction between theoretical and practical teaching

At present, most civil aviation engineering majors in China mainly focus on theoretical teaching. The lack of effective integration of theoretical knowledge and practice in the curriculum and the separation of theory and practice in the teaching process lead to the lack of interest and motivation for students to learn and the failure of theory to guide practice.

2.2. Contradiction between spoon feeding teaching and students' subjective initiative

Training orientation of civil aviation engineering professionals: high-quality composite engineering management talents who are familiar with domestic and foreign industry and professional development trends, have aviation safety awareness, strong practical ability, rigorous style and cooperation spirit, and are in line with high skills, high technology, high quality, internationalization and standardization. The traditional spoon-feeding teaching leads to the students' failure to apply the theory to practice, resulting in the failure to effectively exert the potential of subjective initiative.

2.3. Contradiction between industry skill demand and actual talent training

In terms of practical skills training, some colleges and universities still focus on the examination of theoretical knowledge of courses. Students' participation in actual projects in the industry is low, and there are few opportunities for actual combat. It is impossible to ensure that they can start working immediately after employment, which leads to the fact that the actual talent training cannot meet the requirements of the industry for skills.

2.4. The contradiction between the high cost of practical teaching and the number of teachers and students

On the one hand, teachers and teaching software and hardware resources are limited, and the number of students is increasing year by year. On the other hand, there is a gap between the current professional talent training program and the industry requirements, and there is a lack of a large number of full-time teachers and experimental personnel with dual qualifications.

3. Practical teaching objectives and construction contents

3.1. Reform objectives

(1) In view of the new requirements for civil aviation engineering under the new background of "professional certification + new engineering", the "one body and two wings" structure of experimental practice teaching and the "multi-dimensional" innovative practice teaching system should be constructed;

(2) Innovate the experimental and practical teaching mode of "multi subject multi approach multi stage" based on the cooperation between production and learning, collaborative education, practice and training, and mass entrepreneurship and innovation education;

(3) Establish a whole process throughout the experimental training process evaluation mechanism guarantee mechanism, and propose new strategies for professional teachers to improve their ability.

3.2. Construction content

(1) Establishing the new idea of experimental practice teaching

New engineering and professional certification contain rich connotation. The new engineering discipline focuses on innovation and interdisciplinary integration, and also makes new requirements for engineering quality and comprehensive ability, paying more attention to enterprise practice and engineering education. In the teaching of civil aviation engineering, it is necessary to strengthen the ability to analyze and solve engineering problems, data analysis, teamwork and communication, innovation, lifelong learning, etc. At the same time, it emphasizes the global vision and international exchanges and cooperation.

Under the new background of "professional certification+new engineering", civil aviation engineering needs to integrate new technologies, new theories and new knowledge, such as aircraft operation and flight management, which may be realized by combining and applying some theoretical algorithms of artificial intelligence. In fact, the concept and requirements of new engineering and professional certification should be fully implemented and reflected in experimental practice teaching.

(2) Establishing a new system of experimental practice teaching

Under the new background of new engineering and professional certification, it is necessary to strengthen the innovative design of teaching from the content system of experimental practice teaching, and the new system should strengthen the training of students' engineering quality and the improvement of their practical ability. Explore the design of experimental and practical teaching content for cooperation with enterprises, improve the cooperation between production and learning, industry school integration, practice and training, and strengthen innovation and entrepreneurship practice education and engineering education. Establish a "diversified and three-dimensional" innovative practical teaching system, integrate the resources of various platforms, carry out targeted and focused experimental teaching and practical training for students, and provide all-round three-dimensional practical teaching services for students.

(3) Exploring the New Model of Experimental Practice Teaching

Solve the pain points in the traditional experimental practice teaching mode, explore and establish new methods and new ways of experimental practice teaching, and actively play to the advantages of new ways such as virtual simulation experiment and cloud experiment teaching. The implementation of new teaching methods and approaches needs the professional ability of professional teachers as the basis, so we should seriously explore new strategies for professional teachers to improve their professional ability in the new context.

4. Constructing practical teaching system and methods

4.1. Build a multi-level experimental practice teaching framework

The "diversified and three-dimensional" innovative practical teaching framework (Figure 1), including the "three platforms and four modules" practical teaching system and the three-dimensional and rising practical teaching system, is a practical teaching system established to strengthen students' practical ability and innovation and entrepreneurship ability by using existing experimental platforms and resources to expand students' experimental space.

"Three platforms" include basic skills training platform (basic laboratory, specialized basic laboratory, specialized laboratory), comprehensive ability training platform (training

center, on campus practice base, off campus practice base) and innovation ability training platform (innovation laboratory, research laboratory, mass entrepreneurship and innovation base); The "four modules" include professional practice modules (cognitive practice, professional practice, graduation practice), experimental training modules (confirmatory experiment, comprehensive experiment, design experiment, innovative experiment), exploratory practice modules (curriculum design, curriculum practice, graduation design and thesis) and other practice modules (discipline competition, scientific and cultural activities, social practice).

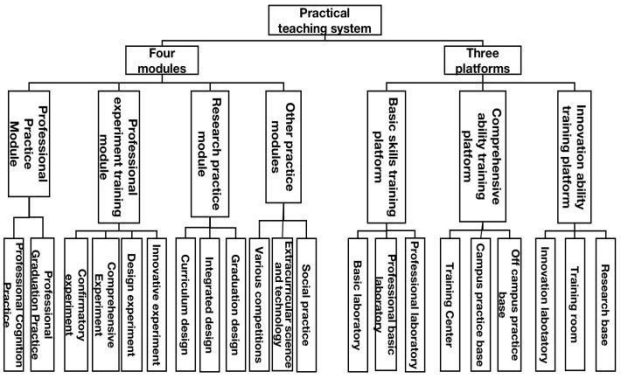

Figure 1. "multidimensional" innovative practical teaching system

At the same time, the three-dimensional experimental platform integrating basic training, skill training, engineering training and innovation training, as well as the two supporting platforms of school enterprise cooperation and practical training education services, combined with the evaluation mechanism of practical teaching process control, can be used to form an ability enhancing practical teaching evaluation system for engineering students to carry out comprehensive ability training, as shown in Figure 2.

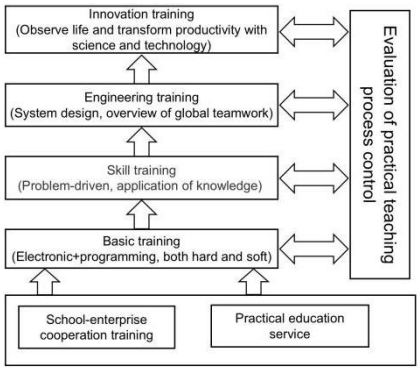

Figure 2. Three-dimensional ascending practice teaching evaluation system

Basic training provides students with comprehensive training from basic knowledge practice to flight plan making and flight control; Skills training helps students establish a mapping between knowledge theory and practical problems by solving some simple deterministic problems; Engineering training enables students to understand and master the process and methods of system design through project driven approach, and then helps students establish a global view and architecture view; Innovation training requires students to learn to observe life, encourage them to open their minds, use professional knowledge to create new works, and turn their imaginations into reality.

Through the "diversified and three-dimensional" innovative practical teaching system, integrate the resources of various platforms, carry out targeted and focused experimental teaching and practical training for students, and provide students with all-round three-dimensional practical teaching services.

4.2. Building a multi-level experimental curriculum system

Multi-level means that according to the four levels of the experimental curriculum system, the civil aviation engineering professional experiments are divided into three levels: professional basic skills training, professional knowledge and application ability training, and research and innovation ability training (Figure 3).

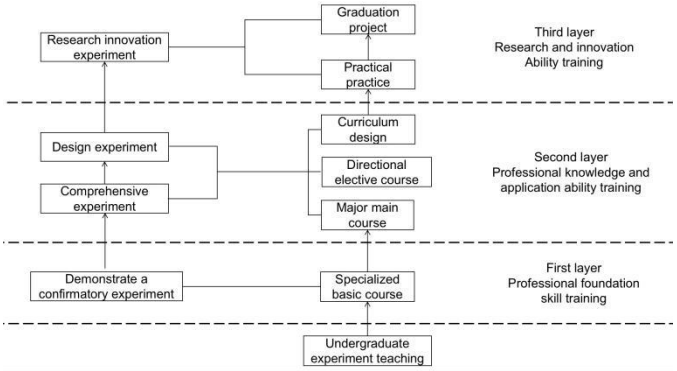

Figure 3. Level of professional experimental practice teaching

The training of professional basic skills is mainly an in-class experiment of the basic courses of the specialty. The nature of the experiment is mainly demonstration and verification, and the purpose is to cultivate students' professional basic literacy and basic application ability; The training of professional knowledge and ability is the experiment and practice of professional main courses and directional elective courses, including the course practice of main courses; The nature of experiments is mainly comprehensive and designed experiments, which cultivate students' professional skills, that is, the ability to comprehensively apply professional knowledge to analyze and solve practical problems; The training of research and innovation ability is mainly to complete the basic quality training of research and innovation ability through social practice and graduation design. It focuses on research or innovative experiments and focuses on cultivating students' innovation ability and innovation concept.

These three levels of experimental system integrate the teaching of knowledge, the promotion of ability and training quality, and promote the overall improvement of students' comprehensive quality.

4.3. Building a four-dimensional teaching experiment model

Through basic training, skill training, engineering training and innovation training, a four-dimensional integrated three-dimensional experimental teaching mode is formed. Practical teaching is carried out step by step to cultivate students' ability in basic knowledge application, equipment operation and application, engineering problem solving and exploration of the future, so as to achieve good teaching results.

(1) Basic training with both hard and soft skills. Focusing on theoretical professional courses such as aviation laws and regulations, and computational courses such as flight

planning and loading and allocation, we will focus on basic training; At the same time, necessary experimental courses are offered on various basic experimental platforms to help students deepen their understanding of basic knowledge through basic training, and basic training is carried out by introducing typical practical cases to expand their knowledge.

(2) Problem driven, knowledge and practice integrated skills training. Focusing on the industrial skill needs of students in different majors and levels of civil aviation engineering, through the introduction of excellent practice cases, the interaction and interest of the classroom are increased, the students' subjective initiative is fully mobilized, students are actively involved in learning, students' application skills are strengthened, and college students' practical skills are improved.

(3) Overall and overall engineering training. In the practical teaching link, the training mechanism of engineering projects is designed around the main line of training project initiation, feasibility analysis, demand analysis, system design and development. Through demonstration, teaching, design, training, experiment and comprehensive innovation, students can complete a series of engineering training projects by themselves, gradually improve their comprehensive ability to use relevant knowledge to solve problems, and promote their theoretical knowledge the coordinated development of practical ability and professional quality.

(4) The innovative training of observing life and coming up with your own ideas. Focus on the cultivation of students' observation and exploration ability, questioning and integration ability, analysis and problem solving ability, communication and cooperation ability, carry out innovation training by designing, hosting and organizing students to participate in important discipline competitions, innovation and entrepreneurship projects and other activities at home and abroad, encourage students to actively observe life details, make accurate judgments, and design appropriate solutions, Build a suitable team and finally form a work or product with obvious innovative characteristics. In this process, let students show their strengths and develop good engineering quality and innovation ability in addition to knowledge, technology and ability.

4.4. Integrate experimental teaching resources and educate people through school enterprise cooperation

(1) Establish a stable practice teaching base. The development of innovative practice activities cannot be separated from the participation of enterprises. It is necessary to cooperate with aviation enterprises to build a practice teaching base.

Strengthen the requirements of students' practical ability link through the way of school enterprise cooperation and integration of production and education to achieve collaborative education; Make full use of various platform resources established by school enterprise cooperation to realize resource sharing and complementary advantages.

(2) Strengthen practical training and education. Through the platform of experimental project demonstration, experimental links, scientific and technological innovation activities, discipline competitions, etc., students' hands-on ability and innovation awareness are cultivated, and engineering practice and innovation education is run through the whole teaching process. At present, the established innovative platforms such as "Civil Aviation Intelligent Equipment and Intelligent Operation Innovation Laboratory", "Low Altitude and Navigation", "UAV Operation and Application" closely link curriculum learning with discipline competition and practical innovation. Students actively participate in discipline competition, and finally achieve the close integration of knowledge and ability elements in curriculum teaching, practical teaching and discipline competition, helping students in knowledge, technology Besides ability, cultivate good engineering quality and innovation ability.

(3) Innovate the type of experimental teaching. Create a distinctive innovation and entrepreneurship model, and build special funds to support students to effectively carry out project-based learning, scientific research training, innovation training and entrepreneurship practice. Through the model of "project demonstration + base training + online observation + project counseling + innovation integration", we can combine red education, professional education and innovation and entrepreneurship education, promote curriculum thinking and politics, and cultivate students' noble feelings of "loving the party and patriotism".

5. Implementation effect

The above construction scheme has achieved remarkable results and achieved rich results. Actively carried out school government cooperation and school enterprise cooperation, and established close cooperative relations with the government and enterprises. Actively develop off campus training bases, provide students with a large number of post placement internship positions, and effectively ensure the employment rate and professional counterpart rate of the major. The teaching team has won a number of teaching research projects and achievements, guided students to participate in extracurricular practical activities at all levels, and won many national, provincial and school level awards and honors.

From the student level, through the rich practical teaching of major settings, students' ability has been significantly improved, the social response is strong, and the employment feedback after graduation is good.

The student team put forward the multi machine low altitude intelligent monitoring, early warning and conflict resolution technology based on the first-generation information technology, which can detect and resolve conflicts more efficiently and timely. At the same time, based on this technical research, the student team also designed and developed a new generation of intelligent monitoring service platform for low altitude airspace to improve the intelligence level of low altitude airspace operation and the efficiency of airspace resources. Some achievements of students in 2022 are as follows:

(1) In July 2022, the National Undergraduate Extracurricular Academic Science and Technology Works Competition won the second prize of Henan Province;

(2) In July 2022, the National College Student Transportation Science and Technology Competition won the third prize of the national level;

(3) In September 2022, the national undergraduate innovation and entrepreneurship training project was approved at the provincial level;

(4) In August 2022, China Internet + College Students Innovation and Entrepreneurship Competition won the third prize of Henan Province.

6. Conclusion

Taking the construction of practical teaching system of civil aviation engineering as the research object, this paper deeply discusses how to effectively build a practical teaching mode of professional certification and multi cooperation education under the background of new engineering. Based on the analysis of the problems faced by the current practical teaching mode, the construction objectives are proposed in combination with the specific construction contents, and specific construction measures are further proposed to provide new ideas and new paths for the construction of new civil aviation disciplines and professional certification, to build an education and training system that matches the sustainable safety of civil aviation and the construction of a powerful civil aviation country, and to provide high-quality civil aviation professionals for the development of civil aviation enterprises and institutions, Improve the service level of the civil aviation industry and enhance the core competitiveness of the industry development.

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The project team has accumulated a lot of research results in the early stage.Fund Projects:

1). Key scientific and technological projects in Henan Province (222102210093): Research on multi-machine intelligent space monitoring, warning and conflict resolution technology based on ADS-B.

2). Research Institute of Laboratory Work in Henan Provincial Universities (ULAHN202145): Exploration on the construction of Empty Pipe and Assignment Experimental Training Platform under the background of new subjects.

3). The Provincial Project of Innovation and Entrepreneurship Training Program for College Students (202210485041): Low-altitude guardian-low-altitude integrated service platform based on ADS-B system.

4). 2022 Research and Practice Project on Educational and Teaching Reform of Zhengzhou University of Aeronautics (zhjy22-82).

5). 2022 Special Subject Construction Project of Zhengzhou University of Aeronautics(2022YJSXK09): Exploration of Master's Collaborative Education Model of Civil Aviation Transportation under the Background of New Subjects.

6). Laboratory opening project in the second semester of the 2021-2022 academic year (No.: 21).

References

[1] Xie Fengying, Wang Hui, Wu Xia, Liu Xu, Zhang Shuang. Strategies for cultivating food professionals in the context of engineering certification and new engineering [J]. Food Industry, 2022,43 (02): 219-222.

[2] Shi Yu, Mao Zhengyu, Li Huiqiang. Exploration and Practice of a New Education Model for Local Colleges and Universities Based on the Professional Certification of Engineering Education and the Concept of "New Engineering" [J]. Contemporary Education Theory and Practice, 2022, 14 (01): 88-92.

[3] Liu Yizhen, Zhou Chongsong, Liu Hui, Deng Bin Research on teaching reform of environmental monitoring course under the background of "engineering education professional certification+new engineering discipline construction" [J]. Journal of Xiangnan University, 2021,42 (05): 96-100.

[4] Wu Hewei, Sun Yanling, Kang Hui. Practical teaching system and platform construction under the background of new engineering and professional certification [J]. Science and Technology Innovation Guide, 2020,17 (16): 207-209.

[5] Wen Wu, Guo Siwen, Deng Xia, Li Peng, Tang Maobin. Exploration on the reform of practical teaching of digital talent training in the context of new engineering [J]. University Education, 2021 (07): 195-198.

[6] Song Qiang, Hu Yaru, Yang Yuan, Shang Jinqian, Zhu Jumei, Xiao Guoqing Construction of practical teaching system for training excellent material engineers in local universities under the background of "new engineering+engineering certification+double first-class" [J]. Journal of Higher Education, 2022,8 (25): 6-9+13.