Research on the Path of Classroom Teaching Quality Innovations in Aviation Vocational and Technical Undergraduate Colleges

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Abstract. This paper explores the challenges and innovations in vocational education, particularly in the aviation industry, focusing on the alignment of educational programs with industry demands. It highlights the importance of integrating industry standards, technological advancements, and practical skills into the curriculum to enhance the adaptability and competitiveness of graduates. The paper presents a comprehensive approach to major construction in vocational colleges, emphasizing innovations in ideology, pathways, and models. By aligning educational programs with the aviation industry's needs, teaching quality monitoring is to improve the effectiveness of vocational education and ensure that graduates are well-equipped with the necessary skills and knowledge to meet the evolving demands of the industry.

Keywords: vocational education, aviation industry, industrial Chain; technology chain; skill chain; innovation chain

1 Introduction

The aviation industry globally has seen unprecedented growth, significantly impacting economic and technological advancements, especially in China. Boeing's "China Civil Aviation Market Outlook" (2020) predicts Chinese airlines will purchase up to 8,600 new aircraft over 20 years, necessitating 395,000 aviation professionals[1]. This underscores the urgent need for high-quality aviation talent.

The Chinese government recognizes aviation's importance and has issued supportive policies, such as the "Opinions of the State Council on Promoting the Development of the Civil Aviation Industry" (2012)[2]and the "Guiding Opinions on General Aviation Industry" (2016)[3]. These policies foster industry growth and create opportunities for talent development.

China's vocational education has also undergone significant reforms, marked by the "Decision on Accelerating the Development of Modern Vocational Education" (2014).

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Subsequent policies, including the "Implementation Plan for National Vocational Education Reform" (2019) and the revised "Vocational Education Law" (2022), strengthened the system, standards, and industry-education integration.

Post-2020, the government intensified support for vocational education with policies promoting high-quality development, emphasizing industry-education integration, school-enterprise cooperation, and the modern apprenticeship system. These policies support aviation vocational undergraduate colleges, crucial for meeting industry demands.

Aviation vocational undergraduate colleges enhance aviation professionals' learning depth and breadth, with natural advantages in industry-education integration and school-enterprise cooperation. They incorporate the latest technologies, standards, and processes into teaching, facilitate training aircraft and component's introduction, establish practical facilities, and improve talent adaptability.

The "National Medium- and Long-Term Education Reform and Development Plan Outline" emphasizes changes in vocational education's enrollment and talent training modes, with aviation colleges serving as key platforms for the modern apprenticeship system, fostering students' professional qualities and abilities.

2 The Problems on Teaching Content and Course Setting

2.1 Alignment with Industry Standards

The teaching content does not align with the latest standards, technical specifications, and safety requirements of the domestic and international aviation industry to ensure that students can directly adapt to industry job demands upon graduation. Establish regular communication mechanisms with industry experts and corporate representatives, and periodically invite them to participate in the review and updating of teaching content to ensure that it stays synchronized with industry development. This includes:

2.2 Technology Updating

the teaching does not focus on the latest technological developments in the aviation industry and promptly incorporate new technologies, materials, and equipment into the teaching plan to enable students to master the most cutting-edge knowledge and skills.

2.3 Standards Integration

the teaching does not integrate industry standards, technical specifications, and safety requirements into the teaching content, and enhance students' industry awareness and practical abilities through case analysis, simulated training, and other methods.

2.4 Assessment and Adjustment

the teaching does not evaluate the tightness of the alignment between teaching content and industry standards based on students' internship performance, employment situations, and feedback from employers, and adjust and optimize it accordingly.

2.5 Integration of Practicality and Theory

The research finds that teaching does not cultivate students' practical operating skills, problem-solving abilities, and innovative thinking through the deep integration of theory and practice.

Regarding course design, the teaching does not adopt teaching modes such as "work-study alternation" and "project-driven learning" to closely combine theoretical teaching with practical operation, ensuring that students can engage in practical operations while mastering theoretical knowledge.

In terms of practical training base construction, teaching does not strengthen the construction of on-campus practical training bases and off-campus internship bases, providing advanced aviation equipment and simulated environments for students to conduct practical operations and skills training.

In the aspect of school-enterprise cooperation, teaching does not establish close cooperative relationships with enterprises, invite corporate experts to participate in practical teaching, provide real project cases and training opportunities, and enhance students' practical experience and professional competence.

3 Discussions on the Path of Classroom Teaching Quality Innovations

In vocational education program development, it is essential to inquire about the market, industry, and application. This research addresses a series of issues related to the connotative construction of majors (and major groups) in higher vocational colleges in a systematic and micro-to-macro manner, spanning from "major setup" to "course design," "teaching scenarios," and "teaching unit design," through "four alignments" based on research into industrial layout, as well as the characteristics of industrial technology chains, skill chains, and innovation chains.

3.1 Aligning with the Industrial Chain to Precisely Establish Major Groups

(1) Adhering to educational orientation and systematic planning

We need to adhere to the educational orientation of "serving aviation, national defense, and the local region", and systematically formulate the school's development plan[4], according to the development strategy of "deepening connotation, improving quality, stabilizing scale, adjusting structure, strengthening management, and developing distinctive features."

(2) Active industry alignment and precision curriculum design

Guided by the aviation and regional industrial planning, we formulate professional development plans, adhering to the principle of "selectively engaging in activities based on our strengths." We comprehensively layout specialties along the aviation manufacturing - aviation operation - aviation maintenance industrial technology chain. Following the principles of "interconnected professional foundations, similar technical fields, related occupational positions, and shared teaching resources," we establish three major aviation specialty clusters centered around Aircraft Digital Manufacturing Technology, Aircraft Electromechanical Equipment Maintenance, Unmanned Aerial Vehicle (UAV) Application Technology, and Flight Attendant specialties, ensuring that the specialty structure aligns with the aviation industry structure [5].

3.2 Aligning with the Technology Chain to Enhance the Connotation of Specialty Groups

(1) Innovating mechanisms and establishing cooperation platforms

We have deepened cooperation with leading enterprises in running schools and have become the only signed higher vocational college with AVIC (Aviation Industry Corporation of China) and AECC (Aero Engine Corporation of China). Following the principle of "resource sharing, complementary advantages, and mutual benefit and win-win results," we have established cooperation platforms such as the "Aviation Vocational Education Group," laying the foundation for collaborative efforts in enhancing the connotation of specialties.

(2) Technology-driven innovation in specialty standards

Guided by technological advancements in the aviation industry, we have joined forces with leading enterprises in the aviation industry and AECC to oversee the opening of a new edition of the national vocational education directory for aviation equipment manufacturing specialties. We have also taken the lead in formulating seven aviation specialty introductions and teaching standards, guiding reforms in the construction of aviation-related specialties [6]. Based on the concept of "core leadership and coordinated development," we have implemented a project for building distinctive and branded specialties, innovatively formulating quality standards for specialty construction and teaching, and comprehensively promoting the connotation construction of specialties.

(3) Pooling advantages and jointly building training resources

Keeping abreast of technological developments in the aviation industry, we have collaborated with Chengdu Aircraft Industrial (Group) Co., Ltd. (CAC), AVIC Unmanned Aerial Vehicle Systems Co., Ltd., and internationally renowned companies. These include national-level demonstrative virtual simulation training bases and a number of off-campus training bases represented by CAC. These efforts have made us a Sino-Swiss innovation and practice demonstration base for intelligent manufacturing and the national training base for the manufacturing team and aircraft maintenance competitions at the 45th and 46th World Skills Competitions.

3.3 Connecting the Skill Chain and Developing Teaching Vehicles for Systematic Instruction

(1) Focusing on Key Skills to Develop Teaching Vehicles

The instructors need to identify and organize the key skill points corresponding to the professional positions of related majors to form a skill chain. Based on various skill requirements, transform typical parts or production cases from enterprises into teaching materials that can effectively support the training of these key skill points. Employ a systematic perspective to construct a streamlined teaching vehicle, extending from majors to courses, to teaching scenarios, and ultimately to individual teaching units.

(2) Integrating the "Four New Elements" to develop core courses

Instructors need to collaborate on the development of talent cultivation programs and course teaching standards, aligning them with professional position standards and industry technical standards. Introduce new materials, technologies, processes, equipment, and real-world enterprise cases into the curriculum to jointly develop distinctive "work-integrated learning" core courses and multimedia teaching resources. By incorporating authentic enterprise cases, production projects, and cutting-edge technologies, the course content will be more closely aligned with actual production practices.

3.4 Connecting the Innovation Chain and Optimizing Science-Education Integration Projects

(1) university-enterprise collaboration to build collaborative Innovation platforms

We need to collaborate with leading enterprises to establish a series of innovation service platforms, such as the "Sichuan Mold Engineering Laboratory, Sichuan Provincial Unmanned Aerial Vehicle (UAV) Full Industry Chain Innovation Platform, Chengdu Aeronautic Polytechnic Institute-Chengdu Aircraft Industry (Group) CAM Technology Center, Chengdu Aeronautic Polytechnic Institute-AVIC Unmanned Aerial Vehicle Airworthiness Technology and Standards Research Institute," among others. These platforms lay a solid material foundation for promoting university-enterprise collaborative innovation, accelerating technological advancements in enterprises, and fostering students' innovative qualities and abilities.

(2) Leveraging platforms to develop collaborative innovation projects

Relying on these university-enterprise collaborative innovation platforms to undertake major projects and complete significant tasks, we could implement a series of vertical and horizontal scientific research projects[7]. For example, collaborating with Shanghai Aircraft Manufacturing Co., Ltd. and Chengdu Aircraft Industry (Group) to undertake projects such as the "Smart Manufacturing Network Demonstration for Large Aircraft," the technological renovation project of Chengdu Aircraft Industry (Group)'s "Automated Quality Inspection and Control System," the outsourcing project of "NC Programming Technology for Aircraft Structural Parts," and the "Wingloong UAV Airworthiness Standards System Development" project. While completing these projects and tasks, based on the needs for cultivating students' innovative qualities and abilities, we will "reprocess" the completed tasks and projects to develop innovative training projects that meet and adapt to students' training requirements. Furthermore, we will

implement an outcomes-oriented curriculum reform, allowing students to participate in scientific research projects and technological breakthroughs, experiencing the entire process of real projects or tasks firsthand, thereby cultivating their innovative consciousness and abilities.

4 Conclusion

In the realm of vocational education, continuous innovation is crucial for addressing the evolving demands of the industry and ensuring that graduates are well-equipped with the necessary skills and knowledge.

This paper presents a comprehensive approach to enhance teaching quality monitor, focusing on three key areas: innovation in ideology, pathways, and models. By integrating these innovations, the aim is to elevate the professional development of students, strengthen the alignment between education and industry, and ultimately, improve the overall effectiveness and efficiency of vocational education. The following sections delve into the specifics of each innovation, highlighting how they contribute to the construction of high-level majors and major groups in vocational colleges.

(1) Innovation in ideology. Curriculum development needs to serve the construction of majors (or major groups). To enhance the level of professional connotation construction and the adaptability of talent cultivation in vocational colleges, as well as to improve the ability of majors to serve industries, major construction must inevitably consider the market, industry, and application, with the logical starting point being the demand for industrial positions. Major construction is a vast and systematic project, and from macro to micro levels, it must adhere to the logical thread of how to implement the cultivation of vocational abilities required by vocational positions. Each link in the design from "major - curriculum - teaching scenarios - teaching units" must be coherent and interconnected. Based on this ideology, this achievement utilizes the "supply-demand fit theory" and "systems engineering" methods to propose "four connections," thereby solving the challenges in the professional construction of vocational education.

(2) Innovation in pathways. The school has established a pathway for high-level major construction. The achievement proposes "four connections": "Connecting with the industrial chain to precisely set up major groups," "Connecting with the technology chain to enhance the connotation of major groups," "Connecting with the skill chain to systematically develop teaching carriers," and "Connecting with the innovation chain to optimize science-education integration projects." This pathway for major group construction achieves a high degree of alignment between the major structure and industrial structure, maximizes the benefits of teaching resources, significantly improves the ability of majors to serve industrial development and school-running efficiency, and forms a universally applicable and advanced "Chengdu Aero technical College Pathway" for major construction that can be promoted.

(3) Innovation in models. The school intends to innovate and form a high-level major group construction model. The achievement proposes that major construction should rely on the support of industry-education integration organizations and school-enterprise cooperation platforms, precisely connect with the development of the aviation

industry, actively adapt to industrial technological progress, and proactively set up majors in anticipation. It fully utilizes the advantages of talent, technology, equipment, and management possessed by leading enterprises to gather high-quality software and hardware resources from both schools and enterprises to build high-level majors. To meet the external requirements of deeply connecting with industries and the internal needs to enhance the school's connotative level and efficiency, majors are comprehensively arranged along the industrial technology chain to achieve clustered development of majors. This innovatively forms a major group construction model of "precise setting, collaborative construction, and clustered development."

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References

1. Boeing. (2020). China civil aviation market outlook. Retrieved from http://www.boeing.com/commercial/market/commercial-market-outlook.
2. The State Council of the People’s Republic of China. (2012). Several opinions of the state council on promoting the development of the civil aviation industry. Retrieved from https://www.chinadaily.com.cn/business/2012-07/13/content_15577770.htm.
3. The State Council of the People’s Republic of China. (2016). Guiding opinions to promote the development of the general aviation industry. Retrieved from https://www.flyingmag.com/general-aviation-in-china.
4. Yang, X. (2023). Construction of a comprehensive teaching system for vocational education under the background of a skill-oriented society: "industry chain—technology chain—professional chain". Vocational and Technical Education, 44(11), 37-42.
5. Mei, Y., Chen, Y., & Fan, S. (2025). An exploration of the construction of higher vocational specialty groups serving the development of local industrial clusters from the perspective of industry-education integration. Vocational Technology, 24(1), 68-73.
6. Liu, B., & Ouyang, E. (2021). The essence, characteristics, and value orientation of industry-education integration in vocational education: A perspective based on coupling theory. Vocational Education Forum, 37(8), 60-67.
7. Wei, H., Zeng, Y., Xiang, X. (2022). Research on the deep integration of vocational education professional chain and industrial chain. Western Quality Education, 8(16), 1-4.