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REFORMING DEGREE EDUCATION IN CIVIL AVIATION TRANSPORTATION FOR INTERNATIONAL STUDENTS FROM BELT AND ROAD PARTNER COUNTRIES: FOUNDATIONS, CHALLENGES, AND PATHWAYS

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Abstract: The Belt and Road Initiative has promoted civil aviation infrastructure connectivity and coordinated air transport development, creating a growing demand for professionals in civil aviation operations and management in partner countries. As a discipline with strong industry relevance, clear regulatory attributes, and occupational orientation, civil aviation transportation provides an important platform for universities to advance higher education internationalization and support the development of the Air Silk Road. In response to challenges such as diverse academic backgrounds, insufficient alignment between course content and civil aviation job competencies, limited adaptation of practical teaching scenarios, incomplete collaborative education mechanisms, and an underdeveloped quality evaluation system, this paper explores reform measures based on the educational practice of the civil aviation transportation degree program. The reform is discussed from five dimensions: training objectives, curriculum system, practical teaching, collaborative education, and quality assurance. By integrating international civil aviation rules and standards, China's civil aviation operational experience, competency training for air traffic control and flight dispatch, virtual simulation training, and cross-cultural adaptation education, this study proposes a degree education pathway for civil aviation professionals from Belt and Road partner countries. The proposed pathway may provide a reference for civil aviation universities seeking to improve the quality of professional education for international students in China.
Keywords: Civil aviation transportation; Degree education; Belt and Road Initiative; International talent cultivation

1 INTRODUCTION

Civil aviation transportation is inherently international in nature. Whether in route network connectivity, air traffic services, airline operations control, flight dispatch, or aeronautical information support, effective operation depends on the alignment of rules and operational coordination among different countries and regions. With the continued advancement of the Belt and Road Initiative, educational cooperation has become an important means of promoting people-to-people connectivity and talent development across partner countries. The Education Action Plan for the Belt and Road Initiative, issued by the Ministry of Education, clearly states that educational cooperation should support talent cultivation and cultural exchange among participating countries [1]. Against this background, providing degree education in civil aviation transportation for international students from these countries is not only an important part of advancing the higher education internationalization, but also a practical measure to support China's civil aviation cooperation and the development of the Air Silk Road.

The quality of international student education has become an important issue in the internationalization of higher education in China. The Administrative Measures for the Enrollment and Training of International Students, jointly issued by the Ministry of Education, the Ministry of Foreign Affairs, and the Ministry of Public Security, sets out basic requirements for the enrollment, training, and management of international students [2]. The Quality Standards for Higher Education for International Students in China (Trial) further state that international student education should be incorporated into the overall quality assurance system of higher education institutions, with requirements covering training objectives, curriculum teaching, language competence, academic assessment, and management services [3]. This indicates that degree education for international students should not be limited to expanding enrollment or offering courses. Instead, greater attention should be paid to the appropriateness of training objectives, the standardization of the training process, and the assessment of training quality.

From the perspective of civil aviation development, the Next Generation of Aviation Professionals Programme (NGAP) proposed by the International Civil Aviation Organization emphasizes the need to ensure an adequate supply of qualified professionals for the operation, management, and maintenance of the future international air transport system [4]. China's 14th Five-Year Plan for Civil Aviation Development also proposes promoting high-quality development of civil aviation and building first-class systems for aviation safety, infrastructure, air transport services, and modern civil aviation governance [5]. Therefore, the education of international students in civil aviation transportation not be limited to the transmission of professional knowledge. It should also strengthen students' understanding of international civil aviation rules, awareness of operational safety, job-related practical competencies, and cross-cultural collaboration skills.

Civil aviation transportation is a field with strong industry orientation and occupational relevance. Students are

expected not only to master basic knowledge in transportation, aviation regulations, aviation meteorology, flight performance, and communication, navigation, and surveillance, but also to understand specific operational processes such as air traffic management, airline operations control, flight dispatch, aeronautical information services, and emergency response. For students from partner countries, the learning challenges are not confined to language barriers. They also arise from differences in prior educational backgrounds, civil aviation operating environments, regulatory systems, professional understanding, and occupational cultures. If training schemes designed for domestic students are simply applied to international students without adaptation, several problems may arise, including insufficient alignment between training objectives and future job requirements, inadequate adaptation of course content to the civil aviation development needs of students' home countries, and limited transferability of practical teaching.

Based on the above considerations, this paper draws on the disciplinary foundation and international education practice of the civil aviation transportation degree program. Focusing on the questions of what kind of international students should be cultivated, how curriculum teaching should be organized, how job adaptability can be improved, and how training quality can be assured, this paper explores a reform pathway for degree education in civil aviation transportation for international students from partner countries, with the aim of providing a reference for civil aviation universities to improve the quality of professional education for international students in China.

2 FOUNDATIONS FOR DEGREE EDUCATION FOR INTERNATIONAL STUDENTS IN CIVIL AVIATION TRANSPORTATION

2.1 External Demand Driven by National Strategies and Industry Development

Within the broader framework of the Belt and Road Initiative, civil aviation has become an important carrier of regional connectivity, personnel mobility, and operational cooperation. For many partner countries, the expansion of airport infrastructure, route networks, and air transport demand has created a growing need for professionals in air traffic control, flight dispatch, operations control, aeronautical information services, and airport operations support. This demand is not limited to general aviation knowledge. It requires professionals who understand international rules, operational safety, and job-specific procedures, and who can work within increasingly connected regional aviation systems.

At the same time, civil aviation talent cultivation has strong global relevance because international air transport relies on unified rules, standardized procedures, and qualified personnel. China's civil aviation sector has accumulated extensive practical experience in safety operations, airport construction, air traffic management, airline operations management, and smart civil aviation development, which provides a practical foundation for developing degree education in civil aviation transportation for international students from partner countries.

2.2 Professional Development as a Foundation for International Student Education

The civil aviation transportation program has long been oriented toward cultivating professionals for frontline civil aviation operations, including air traffic control, flight dispatch, aeronautical information services, and aviation operations support. It therefore has strong industry alignment and a solid practical foundation. The program has been approved as a national first-class undergraduate program, passed engineering education accreditation, and developed a collaborative education mechanism involving both university teachers and industry mentors. During program development, we have established cooperative relationships with the International Civil Aviation Organization, air traffic management authorities, airlines, airports, and other frontline civil aviation organizations, encouraging industry participation in the formulation of training objectives, curriculum optimization, and practical teaching implementation.

In terms of curriculum and platform development, the program has established a number of national and provincial first-class courses. It has also built a relatively complete practical teaching support system based on resources such as the Transportation Navigation Experiment Center, the Airline Operations Control Virtual Simulation Teaching Center, the Communication, Navigation and Surveillance Virtual Simulation Laboratory, the Tower Control VR Three-Dimensional Visualization Training Platform, and the Multi-Runway Full-View Tower Control Simulator Teaching Platform. These courses and platforms provide a foundation for international students to develop professional awareness, receive job-oriented training, and participate in comprehensive practice. They also help transform abstract civil aviation rules and operational procedures into learning tasks that are observable, operable, and assessable.

2.3 Initial Experience Accumulated through International Education Practice

In terms of international education, We have relied on ICAO-related talent development platforms, the Lancang-Mekong Cooperation mechanism, and relevant international cooperation platforms of the Civil Aviation Administration of China to carry out international training programs and degree education for international students in China. It has trained civil aviation professionals in air traffic control, flight dispatch, and related areas for partner countries, and has enrolled international students specializing in flight dispatch within the transportation program. These practices have enabled the civil aviation transportation program to accumulate experience in curriculum development, faculty organization, practical teaching, and student support and management for international student education. They also provide a basis for further improving training objectives, curriculum structure, and quality assurance mechanisms.

3 MAJOR CHALLENGES IN DEGREE EDUCATION FOR INTERNATIONAL STUDENTS

3.1 Differences in Academic Backgrounds Affect Curriculum Continuity

International students come from diverse educational backgrounds and may differ considerably in prior academic experience, mathematical preparation, English proficiency, Chinese language ability, and understanding of civil aviation. Some students may already possess basic aviation knowledge, whereas others may be systematically encountering civil aviation operations and management for the first time. The curriculum of civil aviation transportation is highly sequential, with courses such as aviation meteorology, flight performance, flight dispatch procedures, aviation regulations, and fundamentals of air traffic management closely connected. Without sufficient professional orientation and foundational support at the early stage of study, students may experience difficulties in conceptual understanding, course progression, and learning confidence when entering core professional courses.

3.2 Training Objectives Need Closer Alignment with Job Competency Requirements

Civil aviation transportation is not a purely theoretical field; rather, it is an application-oriented discipline closely linked to industry operations and professional practice. After completing their degree programs, international students may return to their home countries to work in airline operations control, flight dispatch, aeronautical information services, airport operations support, civil aviation administration, or related technical support positions. Therefore, training objectives should go beyond the general statement of "mastering professional knowledge of civil aviation transportation" and clearly specify expected competencies in job performance, rule awareness, safety awareness, and cross-cultural collaboration. If the objectives remain too broad, curriculum teaching and practical training may be confined to knowledge transmission, making it difficult to effectively support students' future professional development.

3.3 Insufficient Alignment among International Rules, China's Experience, and Home-Country Needs

International student education needs to balance three types of content: ICAO rules and general requirements for international aviation operations; China's experience in civil aviation safety management, operations control, and smart civil aviation development; and the development stages and job demands of students' home countries. If the curriculum is merely translated from courses designed for domestic students, it may fail to address international students' academic foundations and future application contexts. This issue is particularly significant for courses related to air traffic control, flight dispatch, and aviation operations. Such courses should not only explain China's civil aviation practices but also help students understand their relationship with international civil aviation rules and encourage them to consider how the knowledge acquired in China can be transferred to the operating environments of their home countries.

3.4 International Adaptation of Practical Teaching Scenarios Needs Further Improvement

Practical teaching in civil aviation transportation relies heavily on simulation training, case analysis, and scenario-based exercises. Domestic students can usually understand the context of Chinese airports, airspace structures, flight operations, and air traffic services relatively quickly. By contrast, international students may face additional barriers arising from differences in language, regulatory background, and cultural experience when engaging with similar cases. If practical cases lack contextual explanation, rule interpretation, and cross-national comparison, students may understand only the procedural steps without fully grasping the underlying operational logic and safety constraints. When practical teaching fails to support the transition from learning through Chinese scenarios to applying knowledge in home-country contexts, its educational effectiveness is likely to be limited.

3.5 Quality Evaluation and Student Support Mechanisms Need to Cover the Entire Training Process

For the civil aviation transportation program, quality evaluation should not rely solely on course grades and graduation theses. It should also consider students' professional understanding, rule awareness, practical abilities, teamwork, language communication, cross-cultural adaptation, and career development. At present, some evaluation methods still place greater emphasis on summative assessment, while giving insufficient attention to students' learning processes, practical performance, and competency development. Therefore, more refined process evaluation and student support mechanisms are needed to form a whole-process quality assurance system covering curriculum learning, practical training, academic guidance, and career development.

4 REFORM PATHWAYS FOR DEGREE EDUCATION FOR INTERNATIONAL STUDENTS IN CIVIL AVIATION TRANSPORTATION

Based on the challenges identified above, this study proposes a reform framework for degree education in civil aviation transportation for international students from Belt and Road partner countries. As shown in Figure 1, the framework consists of five interrelated dimensions: training objectives, curriculum system, practical teaching, collaborative education, and quality assurance. These dimensions jointly support the development of international civil aviation professionals with professional understanding, job adaptability, and cross-cultural competence.

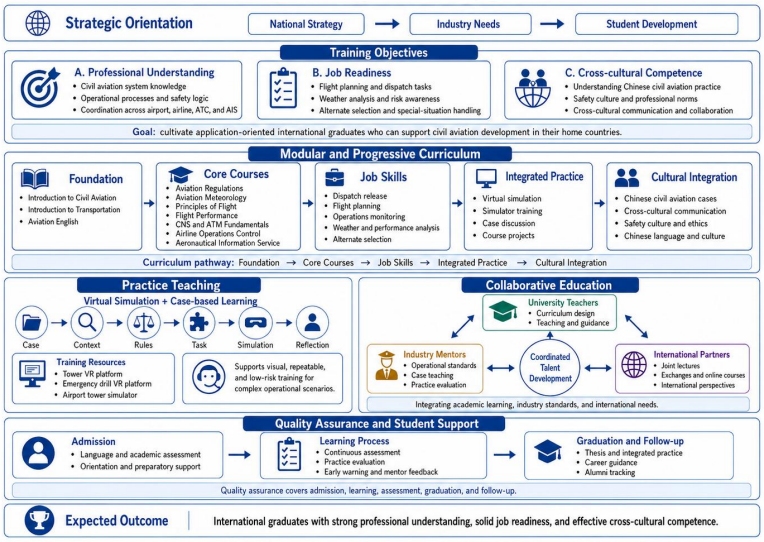

Figure 1 Reform Framework for Degree Education in Civil Aviation Transportation for International Students

4.1 Defining Training Objectives Based on Professional Understanding, Job Adaptability, and Cultural Integration

The education of international students from partner countries should align with national strategic needs, industry development requirements, and students' personal growth. Considering the characteristics of civil aviation transportation, the training objective can be defined as cultivating application-oriented international professionals who understand modern civil aviation operations, are familiar with basic international civil aviation rules and China's civil aviation practices, possess essential competencies in airline operations control, flight dispatch, aeronautical information services, and airport operations support, can communicate and collaborate in cross-cultural environments, and are able to apply what they have learned to civil aviation development in their home countries.

This objective can be understood at three levels. The first is professional understanding, which requires students to master the basic theories, operational processes, and safety logic of civil aviation transportation and to understand the collaborative relationships among airports, airlines, air traffic management units, meteorological services, aeronautical information services, and other actors in the air transport system. The second is job adaptability, which requires students to develop problem-analysis abilities for typical job tasks, such as flight plan preparation, meteorological information interpretation, operational risk identification, alternate airport selection, and handling special situations. The third is cultural integration, which requires students to understand China's civil aviation development experience and industry safety culture, while developing cross-cultural communication skills and awareness of international collaboration.

This objective design is consistent with the orientation of emerging engineering education, which emphasizes industry needs, practical ability, and interdisciplinary integration [6-8]. Emerging engineering education stresses the importance of responding to new demands arising from national strategic development, international competition, and moral education, thereby promoting reform in engineering education [9]. In this sense, educating international students in civil aviation transportation represents a specific practice of industry-oriented engineering education in an international context.

4.2 Building a Modular and Progressive Curriculum System

The curriculum system is central to degree education for international students. Considering international students' learning characteristics and the training requirements of civil aviation transportation, the curriculum can be reconstructed according to the logic of "foundation introduction–professional core–job competency–comprehensive practice–cultural integration."

The introductory foundation module mainly includes introductory courses in civil aviation, transportation, and aviation English. It aims to address students' limited professional awareness and unfamiliarity with the learning context. Through this module, students can understand the basic structure of the air transport system, the learning objectives of civil aviation transportation, and the logical relationships among subsequent courses.

The professional core module mainly includes aviation regulations, aviation meteorology, principles of flight, flight performance, communication, navigation and surveillance, fundamentals of air traffic management, airline operations control, and aeronautical information services. This module aims to consolidate students' knowledge base for understanding the civil aviation operating system. These courses should emphasize the connections among international civil aviation rules, China's civil aviation regulations, and industry operational cases, rather than remaining at the level of concepts and regulatory provisions.

The job competency module focuses on flight dispatch, flight plan preparation, operational monitoring, aviation meteorological information analysis, flight performance limitation analysis, alternate airport selection, and operational

decision-making under special weather conditions. It highlights a teaching approach in which tasks guide knowledge acquisition and scenarios support understanding. For international students specializing in flight dispatch, particular attention should be paid to strengthening their ability to make comprehensive judgments involving weather, performance, fuel, routes, alternate airports, and operational risks.

The comprehensive practice module relies on virtual simulation platforms, simulator training, case discussions, and course projects. It guides students to conduct analysis, make judgments, and engage in collaborative decision-making in complex operational scenarios. The construction of emerging engineering programs should attach importance to systematic design in areas such as training schemes, curriculum systems, practical education systems, and innovation and entrepreneurship education systems [10]. For international students in civil aviation transportation, this module is an important link for knowledge application and competency development.

The cultural integration module includes cases of China's civil aviation development, cross-cultural communication, industry safety culture, professional ethics and norms, and Chinese language and cultural experience. This module is not intended simply to add culture-related courses. Instead, it integrates professional learning with cultural understanding, helping students understand the institutional environment, organizational mechanisms, and safety concepts underlying China's civil aviation practices.

4.3 Promoting Practical Teaching through Virtual Simulation and Case-Based Learning

Many practical scenarios in civil aviation transportation are characterized by high risk, high cost, and limited repeatability. Examples include operations under complex weather conditions, flight diversion, airspace restrictions, airport emergencies, and operational conflict handling. These scenarios cannot be fully reproduced for teaching purposes in real operating environments. Virtual simulation and case-based teaching can provide international students with visualized, repeatable, and low-risk training environments, making them important approaches to improving the quality of practical teaching.

In teaching design, a process of "case introduction–background explanation–rule interpretation–task decomposition–group discussion–simulation exercise–teacher feedback–reflection and summary" can be adopted. In the case introduction stage, typical operational scenarios may be selected, such as flight dispatch under thunderstorm conditions, low-visibility operations at destination airports, flight diversion decision-making, and operational adjustment under route restrictions. The background explanation stage helps students understand airports, airspace, flight plans, and operational rules. The rule interpretation stage connects ICAO rules, China's civil aviation regulations, and industry practice requirements. The simulation exercise stage guides students to complete information analysis, plan formulation, and team communication in a simulated environment. The teacher feedback stage focuses on students' rule understanding, risk judgment, and collaborative efficiency in the decision-making process.

We have established practical teaching resources such as a tower control VR three-dimensional visualization training platform, an emergency response VR simulation training platform, and a multi-runway full-view tower control simulator teaching platform. Visualized, scenario-based, and highly interactive simulation methods have also been introduced into practical teaching. These platforms provide important support for professional practical training for international students and help improve their understanding of complex civil aviation operating scenarios and job adaptability.

4.4 Establishing a Collaborative Education Mechanism Involving University Teachers, Industry Mentors, and International Cooperation Resources

Degree education for international students requires the participation of multiple stakeholders. University teachers are familiar with curriculum systems and students' learning patterns; industry mentors understand civil aviation operating standards and job requirements; and international cooperation resources provide perspectives on home-country needs and international rules. Collaboration among these three parties helps improve the relevance and practicality of talent cultivation.

Specifically, university teachers should be responsible for training scheme design, curriculum development, classroom teaching, and academic guidance. Industry mentors may participate in case teaching, practical training guidance, and competency evaluation in courses such as flight dispatch procedures, air traffic operations, operations control, aeronautical information services, and emergency response. International cooperation resources can help students understand civil aviation operating environments and development needs in different countries through joint lectures, short-term exchanges, online courses, and shared resources from international organizations.

In existing practice, the program has developed a joint mentoring team composed of university teachers and industry mentors, and encouraged frontline civil aviation instructors to participate in practical teaching in areas such as aerodrome control, radar control, and procedural control. This mechanism can be further extended to the education of international students. For example, industry experts may be invited to participate in course project evaluation, comprehensive practical training assessment, and graduation thesis supervision, enabling students to gain a more direct understanding of civil aviation job standards, professional norms, and safety responsibilities.

4.5 Improving a Whole-Process Quality Assurance and Student Support System

Improving the quality of degree education for international students requires a quality assurance mechanism that runs

through enrollment, training, assessment, and graduate follow-up. For the civil aviation transportation degree program, this mechanism should not only meet national requirements for international student education [3], but also reflect the student-centered, competency-oriented, and continuously improved logic of first-class undergraduate education [11]. Accordingly, quality assurance can be strengthened across three stages:

At the enrollment stage, students' language proficiency, professional foundation, learning needs, and career development intentions should be assessed. Professional orientation courses should also be offered to help students understand the program structure, curriculum logic, and learning requirements. For students with relatively weak foundations, preparatory courses, online resources, and mentoring support can be provided.

At the training stage, process evaluation should combine curriculum learning, practical training, academic early warning, and mentor feedback. Course evaluation should not rely solely on final examinations. It should also include classroom participation, case analysis, practical training performance, group collaboration, aviation English communication, and staged learning reports. Practical courses may use task lists, process records, and competency evaluation forms to objectively reflect students' development in problem analysis, problem solving, and team collaboration.

At the graduation stage, training outcomes should be assessed through graduation theses, comprehensive practice, career guidance, and alumni follow-up. Graduation thesis topics may encourage students to address civil aviation development issues in their home countries, such as airport operations support, airline operations control, route network development, airspace management optimization, and flight safety management. In this way, students can transfer what they have learned in China to practical applications in their home countries.

5 CONCLUSION

Providing degree education in civil aviation transportation for international students from partner countries is an important pathway for civil aviation universities to promote educational internationalization, support the development of the Air Silk Road, and contribute to international civil aviation talent cultivation. Compared with general international student education, this type of education places greater emphasis on industry regulations, operational safety, job-related competencies, and cross-cultural collaboration. It is therefore characterized by strong disciplinary specificity, practical orientation, and international relevance. Based on the disciplinary foundation and international education practice of the civil aviation transportation degree program, this paper proposes reform pathways in terms of training objectives, curriculum system, practical teaching, collaborative education, and quality assurance. This study suggests that the education of international students in civil aviation transportation should integrate international civil aviation rules and standards, China's civil aviation operational experience, job competency training, and the development needs of students' home countries. In this way, the training process can move beyond general knowledge transmission toward a balanced focus on rule understanding, competency development, and cross-cultural adaptation. Future efforts should be made to strengthen English-medium curriculum resources, improve differentiated training schemes for different types of students, expand the participation of industry stakeholders and international organizations in talent cultivation, and establish a graduate follow-up mechanism, thereby continuously enhancing the quality of international student education in China and the global influence of civil aviation education.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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