



# The Exploration and Practice of the Construction Path of UAV Application Technology Specialty Under the 1 + X Certificate System

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**Abstract.** With the popularization of UAV technology in the civil field, UAV application technology specialty came into being. The formation time of UAV application technology specialty is similar to that of 1 + X certificate system. Therefore, it is of practical significance to discuss the construction of UAV application technology specialty under 1 + X certificate system. Taking Liuzhou City Vocational College as an example, this paper discusses the construction path of UAV application technology specialty from four aspects: talent training program setting, course certificate integration, double-qualified teacher team cultivation and talent training approach, and puts forward the method of constructing the integrated talent training mode of ‘Post-Course-Competition-Certificate’, aiming to provide ideas and reference for 1 + X pilot colleges and universities.

**Keywords:** 1 + X · UAV Application Technology · Course certificate integration · Double-qualified teachers · Talent training mode

## 1 Introduction

With the expansion of UAV application fields, the demand for UAV application technology professionals is increasing. As an important position for talent training, vocational colleges should take professional construction as the starting point, benchmark professional standards, formulate talent training programs, optimize the structure of teaching staff, improve the curriculum system, and innovate talent training methods to meet the needs of social and economic development for UAV technical talents. The 1 + X certificate system points out the direction and also puts forward requirements for the reform of vocational education. In order to carry out professional construction in vocational colleges, we should fully combine the requirements of the 1 + X certificate system, and construct a talent training mode integrating ‘course certificate, post competition’ from the aspects of curriculum construction, teacher team and talent training methods [1, 3].

## **2 Guided by the 1 + X Certificate System and Based on Professional Research, Optimize the Training Program for UAV Application Technology Professionals**

The talent training program is a programmatic document for professional teaching and a guide to action for daily teaching. The establishment of talent training program should be based on professional research, and set reasonable talent training objectives, talent training specifications and curriculum system. With the introduction of the 1 + X certificate system, the professional function of vocational education is more clear. The 1 + X certificate system requires each pilot college to refer to the latest standards of the industry, fully meet the needs of the post, work-study combination, school-enterprise cooperation, focus on training students to master the core skills of key positions, and realize the seamless connection from school to work. Liuzhou City Vocational College opened the major of UAV application technology in 2020. The professional team carried out professional research according to the working idea of “on-the-job calibration and calibration course.” They went to Guangxi Guihang Technology Co., Ltd., Foshan Shihuan Intelligent Technology Co., Ltd., Guangdong Nengfei Aviation Technology Development Co., Ltd., Shenzhen Nengfei Technology Co., Ltd. and other well-known enterprises in the northern ecological new area to conduct field research, and invited Southern Surveying and Mapping Group, China Aircraft Owners and Drivers Association to visit and exchange. Discuss with enterprise experts on topics such as jobs, employment needs, and talent training models in the field of UAV application technology. The UAV application technology specialty is mainly oriented to the research and development, production, installation, debugging, maintenance, marketing, flight, application, post-processing, ground service, teacher, training, performance and other job settings of UAV in enterprises and institutions. On the basis of extensive teaching and research, the three-level talent training objectives of ‘primary, middle and high’ are determined, which correspond to the initial positions, development positions and expansion positions in the field of UAV application and UAV maintenance [4, 6].

## **3 Construct the Curriculum System of Course Certificate Integration**

In the first to fourth 1 + X certificate list published by the Ministry of Education, there are 8 pilot certificates related to the UAV application technology specialty, including 1 in the third batch and 7 in the fourth batch. According to the guidance of the General Office of the Ministry of Education, the General Office of the National Development and Reform Commission, the General Office of the Ministry of Finance on promoting the pilot work of the 1 + X certificate system (No. 19), the training evaluation organization should integrate high-quality resources and continuously optimize the vocational skill level certificate standards; the pilot colleges and universities apply the relevant resources and projects, combined with the implementation of teaching organization. The certificate assessment standard is regularly updated by the training evaluation organization according to the latest industry standards and job requirements, which is the basis of the connection between classes and posts. According to the certificate standard, the

pilot colleges organize the implementation of teaching. On the one hand, they need to fully study the assessment standards, construct the knowledge framework, sort out the knowledge points and skill points, and form a knowledge system that meets the certificate assessment standards. On the other hand, the pilot colleges should coordinate resources and reasonably handle the relationship between '1' and 'X'. As a pilot college of UAV driving vocational skill level certificate, Liuzhou City Vocational College analyzes the certificate standard, reconstructs the courses of "Introduction to General Aviation," "UAV Simulation Flight," "UAV Structure and Principle," "UAV Flight Control Technology," "UAV Assembly and Debugging," and designs the course certificate integration course system.

The mode of integration of lesson certificate can be divided into four types, namely, the mode of single column, the mode of docking, the mode of deconstruction and the mode of practice. Among them, the single-column mode of the supplement is mainly aimed at the situation that the original talent training program or curriculum system and curriculum standards can not be adjusted in time, but need to carry out separate training for the content of certificate assessment, that is, separate training for 1 + X certificate; docking integration refers to the decomposition and integration of certificate content into several different professional core courses based on the vocational skill level certificate. Students can replace the corresponding credits by completing the learning of the corresponding course modules; the deconstruction and integration mode is to deconstruct the content of the vocational skill level certificate, and to match, transform and integrate with the courses with similar content in the original curriculum system, and then construct a new professional comprehensive training course. After completing the course, students can master all the knowledge points and skills needed for certificate assessment. Practice integration is to let students accept the content of X certificate while experiencing the real work scene through the study of real cases, that is, the content of X certificate penetrates into the study of real scene. This mode needs to rely on the practice base built by school and enterprise or the simulation training place in school.

The examination of UAV driving vocational skill level certificate is divided into two parts: theoretical examination and skill examination, which belongs to the theory and skill and heavy certificate. Candidates are required not only to complete flight preparation, flight task operation and daily maintenance of UAV system, but also to master UAV flight related theories, guide practice with theory, and have the practical ability to implement real work tasks. Liuzhou City Vocational College has a good foundation for school-enterprise cooperation in UAV application technology specialty. It has established a good cooperative relationship with many enterprises and institutions, such as Guangxi UAV Application Association, China UAV System New Technology Industry Alliance, Guangxi Longcheng Branch of Huifei UAV Application Technology Training Center, Guangxi Jinghang UAV Co., Ltd., Beijing Zhongke Haodian Technology Co., Ltd., Shenzhen Kefei Technology Co., Ltd., Guangxi Gengzhi Intelligent Technology Co., Ltd., and has an outdoor training field that can meet more than 100 students for skill knowledge learning and skill training. It has been approved by the Air Traffic Control Office of the Air Force Staff of the Southern Theater Command as a temporary airspace. It has 4 training rooms, an indoor area of 500 square meters, an outdoor area of 1000 square meters, and 50 sets of UAV equipment, with a total value of 2 million yuan.

Starting from the characteristics of UAV driving vocational skill level certificate, based on the existing training conditions and good foundation of school-enterprise cooperation, Liuzhou City Vocational College comprehensively adopts three modes of remedial single-column mode, docking integration mode and practical integration mode in the implementation of course certificate integration. Among them, the docking fusion mode is adopted to decompose and sort out the content of the UAV driving vocational skill level certificate, and match it with many professional core courses such as “Introduction to General Aviation,” “UAV Simulation Flight,” “UAV Structure and Principle,” “UAV Flight Control Technology,” “UAV Assembly and Debugging.” Through integration and transformation, the organic integration of certificate content and course content is realized. Aiming at the certificate content that needs intensive training, the teaching mode of single column mode superposition practice integration mode is adopted to implement the teaching. Separate practical training is carried out in the UAV training room and outdoor training field, including the model installation of flight preparation module, task load assembly and pre-flight inspection. The multi-rotor visual range maneuvering flight and multi-rotor visual range operation flight of the flight task operation module; as well as the daily inspection of the multi-rotor of the daily maintenance module of the UAV system, the daily maintenance of the multi-rotor and the daily inspection and maintenance of the power battery.

Under the 1 + X certificate system, focusing on the teaching objectives of vocational education, the docking integration mode is adopted. The implementation of course certificate integration teaching by means of supplementary single-column mode and practical integration mode not only ensures the achievement of talent training objectives, but also realizes the organic integration of ‘1’ and ‘X’ and the connection between classes and posts, so that students can master the core skills of posts while obtaining academic certificates, obtain corresponding vocational skill level certificates, and improve their employability, which is the basis of the pilot work of 1 + X certificate.

## 4 Cultivation of Double-Qualified Teachers

In 2019, the Ministry of Education, the National Development and Reform Commission, the Ministry of Finance, and the Ministry of Human Resources and Social Security jointly issued the ‘Deepening the New Era Vocational Education’ ‘Double-qualified Teacher Team Construction Reform Implementation Plan’, which clearly proposed to deepen the reform of vocational education and build a double-qualified teacher team. UAV application technology belongs to applied disciplines, which is a professional discipline spawned by industrial development. Its subject attribute determines that professional development is bound to serve industrial development, and also puts forward higher requirements for the quality of double-qualified teachers.

The 1 + X certificate system points out the direction for the construction of double-qualified teachers, providing standards, platforms and resources. At the same time, the double-qualified teacher team also provides a strong guarantee for the implementation of the 1 + X certificate system. It is the backbone of vocational education reform and is related to the development of vocational education. Under the 1 + X system, in order to build a double-qualified teacher team, it is necessary to give full play to the leading role of

party building, seize the opportunity of vocational education development, carry out in-depth school-enterprise cooperation, and build a multi-dimensional teacher team training system from the aspects of standards, training system, talent introduction, ideological and political education, so as to form a linkage benefit of planning, policy and implementation plan.

#### **4.1 Establishing the Evaluation Standard System of Double-Qualified Teachers**

The evaluation standard of double-qualified teachers should be set according to the standard of vocational skill level. Based on the principle of ‘professional classification, teaching stratification and skill classification’, a standard system with practical significance should be established in line with the goal of professional development. First, according to the professional classification, fully investigate and comprehensively analyze the development direction and talent demand of UAV application technology industry, compare the vocational skill certificate standard, and combine the actual situation of teachers to formulate the double teacher evaluation standard; second, teaching stratification, combined with the direction of teachers ‘personal development, co-ordinate the development plan of teachers, from the three levels of public courses, professional basic courses, professional core courses, each with emphasis, to develop a reasonable standard system of hierarchical structure; the third is skill classification. The relevant documents such as the “double-qualified” teacher identification standard of “UAV driving vocational skill level standard” in Guangxi higher vocational colleges are studied, selected and integrated, and the identification standards of junior, middle and senior vocational skills are formulated.

#### **4.2 Construction of Double Quality Teacher Training System**

With the help of the 1 + X certificate system, the sharing channels with the training evaluation institutions are unblocked, relying on the 1 + X teacher training platform, adhering to the principle of “school-enterprise co-construction, internal and external integration,” and building a dual-teacher quality training mechanism. First of all, set up a special post, co-ordinate the annual teacher training plan, take the double-qualified teacher identification activity as the carrier, organize teachers to participate in certificate training and examination according to the ‘Guangxi Higher Vocational College’ double-qualified ‘teacher identification non-teacher series professional and technical certificate catalogue’, promote learning by examination, obtain corresponding vouchers, and improve the double-qualified teacher ratio of teachers; secondly, around the 1 + X certificate pilot work, organize teachers to participate in the teacher training courses run by the training evaluation organization, improve the level of 1 + X teachers, and ensure that each teacher who undertakes the 1 + X training task has the corresponding vocational skills and the qualification of the evaluator.

#### **4.3 Improve the Incentive and Evaluation System of Double-Qualified Teachers**

Pay attention to the accumulation of teachers ‘practical experience and the improvement of practical ability, improve the incentive and evaluation system of double-qualified

teachers through top-level design, stimulate the endogenous motivation of teachers' self-improvement, and actively participate in enterprise practice projects. In the current professional title evaluation and performance appraisal management regulations of Liuzhou City Vocational College, there are clear requirements for teachers to hold posts. For example, for teachers who participate in the evaluation of intermediate professional titles, teaching and research and heavy, social service full-time teachers have accumulated more than 6 months, and teaching-oriented full-time teachers have accumulated more than 3 months. For teachers who have obtained double qualification, a certain bonus is given in the performance appraisal of the year. At the same time, through policies to encourage teachers to improve the quality of double-qualified teachers, it is necessary to avoid the phenomenon of "once and for all," and the incentive standards need to be dynamically adjusted according to industry changes. It is not only necessary to pay attention to the qualification of double-qualified teachers "from scratch" and "from low to high," but more importantly, to strengthen the awareness of teachers' lifelong learning through the system and provide guarantee for "lifelong learning."

#### **4.4 Unimpeded Double-Qualified Talent Introduction Channels**

Among the existing teachers, teachers from fresh graduates lack practical experience in enterprise projects; teachers recruited by the society have certain practical experience in enterprises. However, due to the continuous innovation of technology and industry, it is also difficult to avoid the phenomenon of class derailment if they are limited to teaching in the school. Therefore, in order to ensure the effective implementation of 1 + X certificate work, pilot colleges should actively introduce talents and optimize the structure of teachers. The introduction strategies mainly include: first, recruit powerful young talents and high-level experts from the front line, supplement them to the teaching staff, and optimize the structure of teachers; second, school-enterprise co-construction training platform, recruit technical backbones from enterprises as part-time teachers, and undertake a certain amount of teaching tasks of professional core courses and practical courses; third, regularly invite enterprise experts to school teaching and research, participate in the discussion of talent training programs and curriculum reform; fourth, organize full-time teachers to receive training in enterprises, and realize the two-way flow of talents through the school-enterprise co-construction platform. There are 14 teachers of UAV application technology in Liuzhou City Vocational College, including 4 part-time teachers, all of whom are technical experts recruited from enterprises and have rich project practical experience. In the long-term planning of professional construction, it will continue to recruit high-level technical personnel from enterprises to supplement the existing teaching staff.

#### **4.5 Party Building Leads to Build a Famous Ideological and Political Teacher**

Higher vocational colleges should take moral education as the foundation, build a big pattern of "ideological and political courses" and "curriculum ideological and political education," comprehensively promote "three-wide education," improve the education mechanism of combining morality and technology, and combining work with study. Under the guidance of the thought of "deepening the reform and implementation plan

of ‘double-qualified’ teacher team construction in vocational education in the new era,” we should strengthen the party’s overall leadership in the construction of teacher team, give full play to the leading role of party building, and build a famous teacher of ideological and political education in vocational education. In the pilot work of 1 + X certificate, the construction of curriculum ideological and political education should be based on the route of ‘famous teachers of curriculum ideological and political education-demonstration courses of curriculum ideological and political education-excellent cases of curriculum ideological and political education-teaching supervision of curriculum ideological and political education’, integrate with the reform of the three teachings, integrate ideological and political education into the whole process of teaching staff construction, teaching material reform and teaching implementation, determine the moral education function carried by various courses, fully tap the ideological and political elements, truly integrate ideological and political education into all aspects of classroom teaching, carry forward the socialist values of patriotism, dedication, integrity and friendliness, cultivate the professional spirit of rigorous norms, unity and cooperation, and forge strong craftsmen with both ability and political integrity [7].

## **5 Approaches to Cultivating Innovative Talents**

### **5.1 Mutual Promotion of Competition and Education to Improve the Level of Education**

UAV application technology specialty is an emerging specialty. In order to promote the development of related industries and accelerate the pace of talent training of UAV application technology specialty, the Ministry of Education, Guangxi Education Department and industry associations have issued various incentive policies, among which vocational skills competition is an important means and carrier to activate industrial development, promote university running and carry forward the spirit of craftsmen. Liuzhou City Vocational College has organized students to participate in the Guangxi University UAV Competition since the beginning of the specialty in 2020, and has hosted the fifth Guangxi University UAV Competition, as well as the fifteenth Liuzhou Vocational College and Technical School Student Skills Competition ‘UAV Application’.

The vocational skills competition focuses on the assessment of professional core technical skills, prompting pilot colleges to pay more attention to the quality of talent training, further strengthening the connection between certificate standards, teaching standards and talent training objectives, improving teachers’ teaching level and curriculum construction level, and effectively implementing the concept of promoting teaching, learning and reform by competition [8, 9].

### **5.2 Taking Social Services as the Starting Point to Promote the Transformation of 1 + X Achievements**

As one of the three major functions of colleges and universities, social service is an important means for colleges and universities to serve local industries [10]. It also promotes colleges and universities to further improve teachers’ professional skills and teaching

level, which is an important aspect of the connotation construction of colleges and universities. The connotation construction of colleges and universities is inseparable from the coordinated development of teaching, scientific research and social services. Carrying out vocational skills training for the society is the main form of social services. It has high standards for colleges and universities that undertake training. It requires colleges and universities not only to have certain achievements in the professional field, but also to have excellent teaching level and obtain high social recognition. At the same time, social services are also an important link between society and universities. The latest development of the industry and the demand for jobs are reflected in universities through social services, prompting universities to adjust their own talent training models to adapt to social development. The 1 + X certificate system further promotes the transformation and development of pilot colleges to high-quality vocational skills training. Under the background of 1 + X certificate system, pilot colleges and universities carry out education and teaching reform, constantly adjust the talent training mode, improve teachers' scientific research ability and teaching level, and significantly improve their social service ability. In the two years since the establishment of the UAV application technology major in Liuzhou City Vocational College, the teacher team has been growing, the school-enterprise cooperation has been deepening, and it has gained high recognition in the industry. In order to better serve the local economy, Liuzhou City Vocational College organized the social practice activity of "drone flying rural revitalization dream" in the summer. In the activity, the teachers and students of the drone team used the drone tilt photography technology to collect the data of ancient villages and carry out scientific modeling, so as to formulate more targeted management countermeasures for the ancient villages in Sanjiang County. In order to better maintain its development and inheritance, and lay the foundation for its future sustainable development, make its environment more beautiful, the countryside more livable, the popularity more prosperous, and the villagers more affluent. In addition, "Civil UAV multi-rotor driver license training course" and "DJI Huifei UAV aerial photography technology training course" were also carried out in summer time for the society and other colleges and universities. The main training courses include UAV related theory explanation, UAV driver simulation flight practice, UAV driver practical flight training and other related courses. At the same time, in order to focus on industrial development, active academic atmosphere, broaden the horizons of teachers and students, and promote bilateral exchanges, Liuzhou City Vocational College invited experts in the UAV industry to the school and held a forum on the application of the UAV industry. Through various forms of social service activities, it not only embodies the responsibility and mission of colleges and universities to serve the regional economy, but also promotes the communication between colleges and society, so that the teaching, scientific research and posts of colleges and universities are closely linked, and the curriculum is more in line with the needs of social development. It is also an important source of motivation for teacher development.

## 6 Conclusion

The 1 + X certificate system puts forward new requirements for talent training in vocational colleges, and also provides scientific ideas and frameworks for professional construction and teaching reform. Combining professional construction with the pilot work

of 1 + X certificate system is more conducive to promoting the connection between classes and posts, improving the quality of personnel training and improving the employment rate of counterparts. Under the guidance of the 1 + X certificate system, the UAV application technology specialty of Liuzhou City Vocational College carries out professional construction from the aspects of talent training program, curriculum reform, teaching staff and talent training methods, and constructs a talent training mode integrating 'Post-Course-Competition-Certificate'. We will promote the pilot work of 1 + X certificate in parallel with the reform of the three educations, coordinate resources, build schools and enterprises, continuously optimize teaching conditions, and take multiple measures to cultivate double-qualified teachers, which provides a strong guarantee for the implementation of documentary evidence integration. At the same time, Liuzhou City Vocational College actively organizes various skills competitions, undertakes social training projects such as drone driving, carries out social practice activities such as 'drone flying rural revitalization dream', and constantly explores innovative talent training methods. Improve the strength of teachers, expand the social influence of the school, deepen school-enterprise cooperation, and inject vitality into professional construction and sustainable development.

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