

Pain points and countermeasures in UAV aerial photography training teaching in Chinese universities

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Abstract: With the rapid development of UAV technology, UAV aerial photography practical training teaching has gradually attracted more and more attention in Chinese universities. However, there are some pain points in practical teaching, such as insufficient and untimely updating of practical training equipment, flight safety problems and regulatory restrictions, lack of professional teachers and practical training venues, disconnection between teaching content and industry needs, and limited practical opportunities for students. In order to solve the above problems, this paper puts forward corresponding countermeasures and suggestions, including increasing investment to improve equipment conditions, establishing safety management system and legal education, training professional teachers and building practical training platforms, updating teaching content to keep up with industry development, and carrying out school-enterprise cooperation to provide practical opportunities to display students' practical training works, so as to improve the quality of UAV aerial photography practical training teaching in Chinese universities.

1. Introduction

In recent years, UAV technology has been applied more and more widely in the field of imaging, and UAV aerial photography practical training teaching has become one of the important courses for photography, film and television and other related majors. Through UAV aerial photography practical training teaching, students can master UAV control skills and aerial photography theoretical knowledge and skills, laying a foundation for future work in related fields. However, there are some pain points in UAV aerial photography training teaching in Chinese universities. This paper puts forward specific countermeasures to promote the improvement and development of UAV aerial photography training teaching in Chinese universities.

2. The importance of UAV aerial shooting training in colleges and universities

2.1 Cultivate students' innovative ability

As a new photography technology, UAV aerial photography has been applied in a wide range of fields, including geographic mapping, environmental protection, agricultural monitoring, etc.

Students participate in hands-on teaching and are exposed to the latest drone equipment and technology, which stimulates students' innovative thinking. As the research by Wang Huan, the shooting and expression methods of photography art are constantly changing with the development of science and technology, and the increasing popularity of UAV photography technology has made UAV photography a very important part of modern photography technology^[1]. In practice, middle school students need to constantly try new shooting methods and creativity to achieve the ideal shooting effect, which can not only cultivate students' innovative consciousness, but also improve students' practical ability and problem-solving ability.

2.2 Improving students' skills

In the UAV aerial shooting training teaching, students can not only learn the basic operation, flight principles and shooting skills of the UAV, but also exercise their flight control ability and image capture skills through practice. As Du Ping and Niuxue mentioned that UAV aerial photography technology has significant advantages in commercial photography and other fields, and its integration into photography course teaching is crucial to cultivate students' practical operation ability and adaptability^[2]. Through the practical operation and flight practice of UAV, students can master the control skills of UAV, improve their flight level and shooting skills, and cultivate their innovative thinking and problem-solving ability, so that they can flexibly respond to various challenges in the future work.

2.3 Optimize the teaching effect

In traditional photography teaching, students often can only practice through theoretical learning and flat pictures, lacking opportunities for practical operation and personal experience. With the rapid development of UAV technology, UAV aerial photography practical training teaching provides new possibilities for photography teaching. As Liu Yuanzhong pointed out that the application of UAV aerial photography in photography course teaching not only expands the teaching content and form, but also improves students' practical operation ability^[3]. In the practical teaching, students experience the fun and shooting process of UAV flying, stimulate their learning interest and creative enthusiasm, and improve their knowledge and understanding of photography art. Uav aerial shooting practical teaching can also cultivate students' teamwork spirit, communication and coordination ability, so that students can continue to learn and grow in practice, optimize teaching effect, and improve comprehensive literacy.

2.4 Promoting cross-border integration

An important feature of UAV aerial photography training is to promote the cross-integration of multiple subject areas. While learning UAV operation and photography skills, students can also have an in-depth understanding of geographical mapping, environmental protection, geological understanding and other disciplines. As mentioned by Zeng Shuting, the key segments of the UAV market include aerial photography and entertainment, agriculture and forestry, security, and electricity. Students from all colleges are fully developed as training guides to establish interdisciplinary and cross-field drone course groups^[4]. The interdisciplinary learning style will help to cultivate students' comprehensive quality and innovative ability, so that students can better cope with various challenges and opportunities in their future work.

3. The principles of UAV aerial shooting training in colleges and universities

3.1 Security principles

Combined with the enneagram theory, the safety principle corresponds to the type of "observer" in the enneagram. The observer type is highly alert and perceptive, good at spotting potential risks and taking steps to avoid them. In the UAV aerial photography practical training teaching, teachers should cultivate students' observation ability, so that students can timely discover and deal with the safety hazards in the flight process, and ensure the safety of the UAV aerial photography practical training.

3.2 The principle of practicality

The practical principle requires that the content of UAV aerial photography training teaching should be close to reality and pay attention to training students' practical operation ability. Combined with the theory of enneagram personality, the practical principle corresponds to the type of "helping person" in enneagram personality. Helper-type people have a strong sense of responsibility and the spirit of helping others, willing to help others solve problems. In the UAV aerial photography practical training teaching, teachers should guide students to pay attention to practical application scenarios, cultivate students' ability to solve practical problems, so that students can quickly adapt to the needs of the UAV aerial photography industry after graduation.

3.3 Scientific principle

The scientific principle requires the UAV aerial photography training to follow the scientific teaching methods and procedures. Combined with the theory of enneagram personality, the scientific principle corresponds to the type of "thinker" in enneagram personality. The thinker type has high logical thinking ability and intellectual curiosity, pursues truth, and focuses on rational analysis. In the UAV aerial shooting training teaching, teachers should pay attention to the combination of theoretical teaching and practical operation, guide students to use scientific methods to analyze and solve problems, and cultivate students' innovative ability and scientific spirit.

3.4 The principle of comprehensiveness

The comprehensive principle requires that the UAV aerial photography training teaching should pay attention to cultivating students' ability in many aspects and realize the integration and application of knowledge. Combined with the theory of enneagram personality, the principle of synthesis corresponds to the type of "coordinator" in enneagram personality. Coordinators have good interpersonal and teamwork skills, and are good at integrating various resources to achieve coordination and development. In the UAV aerial shooting training teaching, teachers should pay attention to cultivating students' teamwork ability, communication ability and innovation ability, so that students can better cope with various challenges in the future work.

4. Pain points in UAV aerial photography training teaching in Chinese universities

4.1 Insufficient training equipment and update is not timely

In the UAV aerial photography training teaching in colleges and universities in China, the shortage of practical training equipment and the delay in updating has become a significant problem. According to the "China Higher Education Equipment Market Research Report" released by China

Education Equipment Procurement network in 2023, at present, about 50% of colleges and universities in China are insufficient in the amount of equipment for UAV aerial photography training courses, with an average of one drone for every 10 students^[5]. According to the data of DJI Innovation, the world's leading drone manufacturer, it launches new drone products every year, and the performance and functions have been improved. However, due to limited funds, many colleges and universities can not keep up with the pace of market development in equipment update, resulting in students in the process of practical training, unable to access the latest UAV technology and functions, thus affecting students' learning and practice ability.

4.2 Flight safety issues and legal restrictions

In the course of flight, drones will encounter various safety risks, such as loss of control, collision, crash and so on. According to the Civil Aviation Administration of China's "Regulations on the Operation of Civil Unmanned Aerial Vehicle Systems" released in 2023, there were a total of 57 drone accidents in China in 2022, with 43% of these accidents caused by loss of control. In addition, China has strict regulatory restrictions on drone flight activities, including limitations on the flight range and altitude of drones. For instance, Article 16 of the "Regulations on the Operation of Civil Unmanned Aerial Vehicle Systems" states that drones must not fly overhead in densely populated areas, airport clear zones, and other specified regions, and their flight altitude must not exceed 120 meters. Additionally, there are strict regulatory restrictions on drone flight activities in China, including limitations on the flight range and altitude of drones. For instance, according to Article 16 of the "Regulations on the Operation of Civil Unmanned Aerial Vehicle Systems" issued by the Civil Aviation Administration of China (CAAC), drones are prohibited from flying overhead in densely populated areas, airport clear zones, and other specified regions, and their flight altitude must not exceed 120 meters. Furthermore, drone operators are required to possess a civil aviation out-of-sight pilot license issued by the CAAC. They must also apply for and obtain airspace authorization in advance and comply with relevant laws and regulations, such as the "Civil Aviation Law of the People's Republic of China", the "Regulations on General Aviation Flight Management", and the "Interim Regulations on Unmanned Aerial Vehicle Flight Management" which were issued and implemented in 2024. These regulations contain explicit provisions. However, these regulations limit the performance and functionality of drones that universities can utilize for aerial photography training and teaching. When conducting drone aerial photography training, universities must strictly comply with the relevant regulations to avoid legal liabilities.

4.3 Lack of professional teachers and training venues

Uav aerial photography is a highly practical course, which requires teachers to have rich theoretical knowledge and practical experience. However, at present, there are few teachers with UAV aerial photography professional background in Chinese colleges and universities, and many teachers have insufficient theoretical knowledge and cannot effectively guide students to carry out practical training. According to the data of China Education Statistical Yearbook in 2023, the number of full-time teachers of DRone-related majors in ordinary undergraduate colleges in China only accounts for 0.3% of the total number of teachers, and the teachers with professional background of UAV aerial photography are even fewer. A suitable training site should have open airspace, diverse terrain and good weather conditions. However, due to the accelerated urbanization process, there are less and less suitable venues for UAV aerial photography, which leads to the dilemma of insufficient venues for UAV aerial photography practical training teaching in colleges and universities. In addition, according to Article 15 of the "Regulations on the Operation and Management of Civil Unmanned Aircraft Systems", UAV flight activities should avoid areas such

as military restricted areas and important facilities, which further limits the choice of training venues for UAV aerial photography.

4.4 The teaching content is out of line with industry needs

Uav aerial photography technology is changing with each passing day, industry application scenarios are constantly expanding, and the demand for relevant skills is also increasing. According to the "2019 China UAV Industry Development Report" released by the Aviation Industry Development Research Center of China, it is expected that by 2025, China's UAV market will reach 60 billion yuan, and the professional-grade UAV market will exceed 30 billion yuan, which means that the application of UAV aerial photography in various fields will be more and more extensive^[6]. However, in the setting of UAV aerial photography teaching content, colleges and universities still stay in the teaching of basic skills and theories, and the in-depth discussion and case analysis of the practical application of UAV aerial photography are relatively insufficient. As a result, although students have mastered certain UAV aerial photography skills after graduation, it is difficult to quickly adapt to and meet the needs of high-quality and application-oriented talents in the industry. There is a serious disconnect between teaching content and industry demand.

4.5 Students have limited practical opportunities

In the UAV aerial photography training teaching in colleges and universities in China, students' practice opportunities are generally limited. According to the data of China Education Statistical Yearbook in 2023, the number of full-time students majoring in drones in ordinary undergraduate colleges in China accounts for 0.7% of the total number of students, and the average practical operation time of these students in the UAV aerial photography training course is only 3 hours per week. On the one hand, it is difficult for students to practice fully in class due to the lack of training equipment and the delay in updating. On the other hand, flight safety problems and legal restrictions make colleges and universities often cautious when organizing outdoor practical training; In addition, due to the lack of professional teachers and training venues, students have limited opportunities to practice in school. The combined effect of all the above factors makes it difficult for students to get enough practical training in the UAV aerial shooting training teaching, thus affecting students' skill mastery and career development.

5. Countermeasures and Suggestions

5.1 Increase investment and improve equipment conditions

(1)Optimize the procurement and update mechanism of UAV aerial photography equipment

In the current UAV aerial photography practical training teaching in colleges and universities, the procurement and update of equipment is particularly important. In order to improve the teaching quality and cultivate students' professional skills, colleges and universities should pay attention to the upgrading of UAV aerial photography equipment and establish a scientific and reasonable equipment procurement and update mechanism. Specifically, universities should regularly evaluate and update UAV aerial photography equipment according to market demand and industry development trends to ensure the technical advancement and practicality of the equipment. Colleges and universities can also establish cooperative relationships with UAV manufacturers or dealers, through leasing, sharing and other ways, to provide students with more practical operation opportunities. In order to ensure the safe and compliant use of equipment, colleges and universities should develop corresponding management systems, clarify operating procedures and maintenance

responsibilities, and ensure the efficient operation of UAV aerial photography equipment.

(2)Strengthen the construction of aerial photography training base and improve facilities

The development of UAV aerial shooting training teaching in colleges and universities cannot be separated from the construction of training bases and the improvement of facilities. Colleges and universities should choose suitable locations to establish aerial shooting training bases, and fully consider geographical location, airspace conditions, environmental characteristics and other factors to ensure the safety and compliance of the training bases. Colleges and universities should be equipped with all kinds of UAV aerial photography equipment, including UAV aircraft, photography and camera equipment, data processing software, etc., to meet the needs of different teaching scenarios. Colleges and universities should also establish and improve the management system of practical training bases, standardize the practical training teaching process, and ensure the orderly conduct of teaching activities.

5.2 Establish safety management system and legal education

(1)Develop safety management norms for UAV aerial photography

As a new photography technology, UAV aerial photography has been widely used in the practical training and teaching of colleges and universities. However, with the continuous development of UAV technology, the safety problems in the process of aerial photography have become increasingly prominent. In order to ensure the safe and smooth implementation of UAV aerial training and teaching, colleges and universities should develop safety management norms for UAV aerial photography. It includes clarifying the permitted scope, flight height and flight time of UAV aerial photography to ensure that flight activities comply with relevant laws and regulations. Colleges and universities should also establish and improve the management system of UAV aerial photography equipment, strengthen the management and maintenance of aircraft, photography and camera equipment and other equipment, and ensure the safety and reliability of equipment. Meanwhile, colleges and universities should regularly organize teachers and students to conduct safety training, improve safety awareness and emergency handling capabilities, and reduce possible risks during drone aerial photography.

(2)Carry out legal education to strengthen flight safety awareness

In UAV aerial photography training, it is crucial to strengthen flight safety awareness. Colleges and universities should actively carry out legal education to let students have a deep understanding of relevant laws and regulations of UAV aerial photography, including the national policies and regulations on UAV flight, as well as the regulations of relevant institutions such as Civil Aviation Administration and air traffic control department. Through legal education, students can understand the legal scope and relevant regulations of UAV aerial photography, avoid violations in actual operation. At the same time, colleges and universities guide students to establish correct flight ethics, consciously abide by flight discipline, and ensure the safety and compliance of UAV aerial shooting training teaching. Colleges and universities hold flight safety knowledge competitions, flight simulation and other forms of activities to improve students' flight safety awareness, so that students can strictly abide by relevant regulations in actual operation.

5.3 Training professional teachers and building practical training platforms

(1)Introduce industry experts to participate in teaching

In order to improve the professional level of UAV aerial photography training teaching, colleges and universities should actively introduce industry experts to participate in teaching, not only provide students with the most cutting-edge industry knowledge, but also allow students to contact the actual work experience and skills, colleges and universities through cooperation with enterprises,

invite industry experts with rich practical experience to give lectures or participate in course teaching, so that, Students learn about the latest trends and developments in the industry to lay a solid foundation for future employment. At the same time, the participation of industry experts can also promote the exchange between college teachers and the industry, stimulate teachers' teaching enthusiasm and innovative thinking, and further improve the quality of teaching. Colleges and universities can also hire industry experts as instructors for practical teaching, provide one-to-one guidance for students, and help solve problems encountered in practical operation.

(2) Establish a UAV aerial photography training teaching system

The construction of UAV aerial shooting practical training teaching system is the key to improve the quality of practical training teaching. Colleges and universities should formulate reasonable practical training teaching plans, clarify the objectives, contents, methods and evaluation standards of practical training courses, set up practical training courses according to market demand and industry development trend, and ensure the practicability and pertinency of course content. Colleges and universities should also strengthen the construction of teachers in practical training teaching, introduce teachers with rich practical experience and professional skills, and improve the overall level of practical teaching. Colleges and universities should increase the investment in practical training equipment, and configure various types of UAV aerial photography equipment to meet the needs of different teaching scenarios. Colleges and universities establish and improve the management system of practical training bases, standardize the practical training teaching process, ensure the orderly conduct of teaching activities, construct and improve the UAV aerial photography practical teaching system, colleges and universities will be able to better train students' practical ability and innovation ability, and transport high-quality talents for our country's UAV aerial photography industry.

5.4 Update teaching content and keep up with industry development

(1) Integrate cutting-edge technology into the teaching syllabus

In the UAV aerial photography practical training teaching, it is very important to keep up with the development of the industry and integrate cutting-edge technologies into the teaching syllabus. According to the market demand and industry development trend, colleges and universities timely update the teaching content to ensure that students can master the latest UAV aerial photography technology. For example, the teaching content of UAV automatic driving, intelligent obstacle avoidance, image recognition and other advanced technologies is increased, so that students can understand and master cutting-edge technology applications. At the same time, universities should also strengthen the teaching of UAV aerial photography software tools, such as aerial photography planning software, image processing software, etc., so that students can skillfully use these tools for aerial photography production.

(2) Regularly organize lectures and seminars to exchange experience

In order for students to keep up with the development of the industry, universities should regularly organize lectures and seminars, invite industry experts and scholars to share the latest research results and experience, so that students can directly understand the latest trends and development of the industry and broaden their horizons. In the lectures and seminars, students can communicate with experts face to face and answer questions, so as to have a deeper understanding of the principle and application of UAV aerial photography technology. Colleges and universities can also organize UAV aerial photography competitions and exhibitions inside and outside the school, encourage students to participate, cultivate students' teamwork spirit and innovation consciousness, and promote students to accumulate experience and improve their professional skills. Lay a solid foundation for future employment.

5.5 To carry out school-enterprise cooperation and provide practical opportunities

(1) Establish cooperation mechanism with UAV enterprises

Colleges and universities should take the initiative to establish a cooperation mechanism with UAV companies in order to provide more practical opportunities for students, and cooperation can be multi-faceted, including technical exchanges, project cooperation, and resource sharing. Colleges and universities can jointly carry out technical research with enterprises, so that students can participate in it, so as to improve students' practical ability and innovation ability. Enterprises can also provide training bases for colleges and universities, so that students can master UAV aerial photography skills in actual operation.

(2) Carry out practical training projects and provide practical operation platform

In order to enable students to better master UAV aerial photography skills, colleges and universities should actively carry out practical training projects and provide practical operation platforms for students. The practical training projects can include UAV aerial photography course design, practical engineering projects, scientific research topics, etc. In the practical training projects, students can apply the theoretical knowledge they have learned to practical operations and improve their practical ability. At the same time, colleges and universities can also cooperate with enterprises to let students participate in the actual projects of enterprises, so that students can exercise themselves in the real working environment, colleges and universities can also organize students to participate in various kinds of UAV aerial photography competitions, so that students can improve their skills in the competition. Through the practical training program, students will have a better understanding of the actual needs of the drone aerial photography industry and be prepared for future employment.

5.6 Establish an incentive mechanism to enhance students' learning interest and enthusiasm

(1) Display and evaluation of students' practical training works

In order to stimulate students' learning interest and enthusiasm, colleges and universities should regularly carry out demonstration and evaluation activities of students' practical training works, which can not only provide students with an opportunity to show their practical training results, but also stimulate students' creative enthusiasm and sense of competition. Through exhibition and evaluation activities, students can get feedback and suggestions from teachers and industry experts to improve their professional skills and creative abilities. In addition, the exhibition and evaluation of practical training works can also promote exchanges and cooperation among students, so that students can continue to learn and grow in practice. Colleges and universities organize exhibitions, seminars, network platforms and other forms to carry out these activities, providing students with more opportunities to display their practical training works.

(2) Establish a library of students' practical training works and a sharing platform

In order to enhance students' learning interest and enthusiasm, colleges and universities should establish a library and sharing platform for students' practical training works, which can be an online database. Students can upload their works created during the practical training to the platform for other students, teachers and industry experts to browse and evaluate, so that students can get more feedback and suggestions, so as to improve their professional skills and creative level. At the same time, this platform can also promote exchanges and cooperation between students, so that students continue to learn and grow in practice, colleges and universities through cooperation with professional UAV aerial photography enterprises, the use of technology and resources to establish and maintain this platform, colleges and universities can also encourage students to actively participate in the construction and operation of this platform, so as to enhance students' teamwork ability and innovation awareness.

6. Conclusion

With the continuous progress of UAV technology and the expansion of industrial applications, colleges and universities should increase investment, update equipment, strengthen safety management and legal education, train more professional teachers, build practical training platforms, keep up with the development of the industry, update teaching content, strengthen school-enterprise cooperation, and provide more practical opportunities. Colleges and universities can strengthen cooperation and share resources to promote the exchange and development of UAV aerial photography training teaching. Through continuous efforts, it is expected to improve the teaching level of UAV aerial photography practical training in Chinese universities, cultivate more high-quality and application-oriented UAV aerial photography talents, and meet the industry's demand for UAV aerial photography skills talents.

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