

The integration and application of UAV in engineering surveying teaching under the background of “1+X”

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Abstract: UAV technology has made great progress in recent years, which undoubtedly changes the working methods of various field work and greatly reduces the time and intensity of field work. Engineering surveying work runs through all stages of the whole engineering construction, engineering surveying field work lasts a long time, the intensity is large, the traditional measurement method data collection density is limited, can not directly reflect the original terrain features. The development of UAV aerial survey technology undoubtedly provides an optimal solution for this problem at present. The jobs of civil engineering students in vocational colleges are mainly technicians in the construction line, and measurement skills are one of the most important vocational skills. If the latest measurement new technical skills are effectively integrated into classroom teaching, they can effectively cope with most of the measurement scenarios in construction in the future work, and enhance their professional competitiveness. The purpose of this paper is to discuss how to effectively integrate the UAV measurement technology into the teaching of non-surveying and mapping major with limited class hours.

Key words: 1+X; Drone surveying and mapping; Engineering surveying; Teaching reform

In recent years, the implementation of “1+X” higher vocational education model has put forward new requirements for the training of engineering surveying technical personnel. Under this mode, engineering surveying majors in vocational colleges need to actively explore and innovate teaching content, teaching methods and teaching means to adapt to the trend of industrial development and talent demand. With the rapid development of UAV technology, as a new engineering measurement tool, the integration and application of UAV in engineering measurement teaching has become an important topic in the construction of teaching system in this field. The traditional teaching methods of engineering surveying mainly focus on theoretical teaching and field measurement, but the teaching effect is limited, and it is difficult to meet the practical needs and vocational reserves of students. Uav has the advantages of high precision, high efficiency and low cost, and can be used in many fields such as surveying, photography and terrain analysis. Therefore, the application of UAV in engineering surveying teaching has a very broad application prospect and social significance.

As a higher vocational college of civil engineering, it is imperative to add UAV measurement technology to students’ Engineering measurement course. As a vocational college teacher has the obligation and necessity to teach this new technology to students, so that they can broaden their horizons and enhance their vocational adaptability and competitiveness.

1. The problems facing the practical training of engineering surveying course

As a practical course in civil engineering, engineering surveying has changed with the continuous development of science and technology. The rapid development of UAV technology makes it become a new type of measuring tool, which has the advantages of light and portable, simple operation, high precision data, fast and safe. Uav surveying and mapping technology has irreplaceable advantages in topographic map surveying and mapping, earthwork calculation, project progress image display, scene modeling and other aspects. In the northern region, UAV surveying and mapping technology is especially suitable for scenes where the surface vegetation is sparse.

At present, the addition of UAV surveying technology is very limited in the teaching and practice of engineering surveying courses in the college. Therefore, how to effectively integrate UAV surveying technology into engineering surveying teaching has become a problem that needs to be solved at present. Combining UAV surveying and mapping technology with traditional surveying means can help students compare the differences of different surveying methods in dealing with the same problem, understand the uniqueness of the results of different methods in dealing with the unified problem, and understand the advantages and disadvantages of different surveying methods in dealing with the problem. This can not only improve students’ measuring skills and practical ability, but also be very helpful for students to choose measuring equipment and methods and check the correctness of measurement data in the future.

In addition, some contents in engineering surveying teaching are no longer suitable for the actual scene, such as steel scale distance measurement, etc., in the UAV surveying and mapping technology into engineering surveying teaching, the old content can be appropriately deleted to provide time guarantee for the addition of UAV surveying and mapping content.

Therefore, this paper aims to explore how to integrate UAV surveying technology into engineering surveying teaching, and how to optimize engineering surveying teaching and improve the quality of education. The research has important practical significance for strengthening the practicality of engineering surveying teaching and improving students’ surveying ability.

2. Effectively promote the practical teaching of UAV surveying and mapping technology in engineering surveying courses

2.1 Change the teaching concept from the original intention of vocational education

The initial intention of vocational education is to cultivate high-quality skilled talents who can meet certain tasks, so skills are the foundation of vocational students. With the continuous development of UAV technology, it is an important measure for higher vocational

education to effectively improve teaching quality to integrate UAV surveying technology into engineering surveying teaching and strengthen practical teaching.

In the course of teaching, it is necessary to change the idea, reduce the class time of relevant theoretical teaching, and increase the practical teaching of new technology of UAV surveying and mapping based on practice. This will help students master the advantages and disadvantages of UAV surveying and mapping technology, plan the key elements such as the altitude of field flight, overlap rate, the impact of the height change of terrain and landform on the results, and how to arrange the image control points, so as to collect qualified aerial photo data. In addition, in order to stimulate students' interest in learning, the teaching process should make use of students' curiosity about drones and guide students to understand the functions of drones themselves, such as the structure, flight principle and control technology of drones. By strengthening practical teaching and increasing the teaching hours of UAV surveying and mapping new technology practice, students can be more closely exposed to advanced technology, have a deeper understanding of the industry development trend and frontier technology, and be more able to adapt to the requirements of work tasks in the future employment.

Therefore, taking practice as the main line, strengthening practical teaching and integrating UAV surveying and mapping new technology practical teaching can effectively improve the education quality of higher vocational education, promote the overall development of students, and meet the purpose and requirements of higher vocational education.

2.2 Enrich the content of practical teaching according to the needs of work scenarios

The work of engineering survey runs through the whole process of engineering life, from the preliminary survey in the feasibility stage to the detailed survey in the design stage, the lofting and earthmoving calculation in the construction stage, and the deformation observation in the operation stage. Engineering survey is the first link, especially in the research stage and design stage to obtain the terrain quickly and accurately, help to improve the quality of research and design, reduce unnecessary errors, increase the reliability of engineering quantities, improve the accuracy of budget estimate, has a vital significance for the control of the whole life of the project.

Extract the typical work from the work scene, decompose the technical details in the work process, simulate the actual design teaching content, grasp the key links, rationally set the field and internal industry training subjects, strengthen the detailed operation, and diversify the methods of results checking. It will be formed into work instructions and video tutorials. In the training process, the teacher first explains the key points and precautions of the training, and the students carry out the training in strict accordance with the training instructions. Those who are not familiar with the use of the equipment can watch the video recorded by the teacher repeatedly to guide and master the operation methods.

2.3 Improve the security mechanism from the perspective of safety first

The main reason why most teachers do not want or dare not promote UAV in engineering surveying is that the safety risk in the field operation of UAV surveying and mapping is far greater than that of traditional surveying and mapping instruments. The main safety risk of traditional surveying and mapping equipment is the safety risk caused by students' inadequate control of the equipment, such as: instrument damage caused by illegal operation, accidentally knocking down the tripod and breaking the equipment. UAV surveying and mapping practical training is not only the safety of instruments and equipment, but also the personal safety of students and airspace safety. In general, multi-rotor aircraft is used in the training process. The power source of multi-rotor aircraft is the blade of high-speed rotation, which will have personal safety risks. Equipment safety is generally improper operation into buildings, trees and so on. Airspace safety lies in the general mapping of the flight height of small and medium-sized multi-rotor aircraft between 80 and 150, sporadic practical training is difficult to apply for airspace, time dispersion is high, approval time is long, and there is flight non-compliance.

Since the UAV is a fresh equipment for most students, they have little understanding of it, strong curiosity and insufficient attention to safety. First of all, it is necessary to enhance the safety awareness of practical training teachers and students, do a good job of safety education and training in advance, standardize the operation procedures, and manage the remote control of drones in the process of replacing batteries, starting and starting.

2.4 Strengthen the quality assessment according to the requirements of the quality of the results

In order to increase the training effect of students, it is necessary to put forward requirements for the training of students from the aspect of quality assessment. The assessment mechanism is connected with the assessment method of UAV pilot of the National Civil Aviation Administration, which is divided into theory and practical operation. The theory content is a basic professional course in this semester, and the assessment adopts the existing AOPA question bank. The practical test adopts electronic piles, which can be adjusted and relaxed according to the weather conditions. Finally, the screenshot of the student's flight trajectory is saved as the basis for the students' practical training results. It also comments on the problems existing in the students' flight and points out the problems.

2.5 Actively docking the "1+X" exam, and promoting the skill identification of third-party institutions

According to the "1+X" certificate UAV surveying and mapping direction of the enterprise's primary and intermediate examination outline. First of all, the course teacher takes the UAV surveying and mapping evaluation qualification, fully understands the content of the junior high school advanced examination, and reflects it in the concentrated practical training week in the talent training program and the engineering surveying course standards. Through the examination of X certificate, enhance the students' social identification of their skills and enhance the students' vocational skills. The certificate link in the post course competition certificate can be fully reflected here, and it also actively responds to the Ministry of Education's 1+X teaching reform for higher vocational students.

"1+X" UAV photogrammetry professional grade examination. Junior high school advanced examination requires different levels to master the basic concepts and basic principles of photogrammetry; To master the structure and flight operation of UAV; Understand the

layout and measurement methods of image control points; Master the preliminary knowledge and operation process of null three encryption, DSM and DOM data production. With the gradual progress, combined with the needs of production enterprises, it can effectively solve the needs of students to learn, adapt to and master the skills required for future production positions during the school period, and provide strong support for improving the reliability of talent training.

2.5 Reflect on the teaching process, adjust the course standards, and improve the training instructions

There will be many situations that are not considered in advance in the training, such as: student management, safety protection, training methods, and training effects. It is necessary to summarize the problems existing in the training in time, and keep iterating and improving. The results will be reflected in the training manual and course standards to form a continuous and continuous written record. It enables students to pay attention to the safety management system, flight safety, standardize the use of various tools, effectively improve the UAV training effect, improve students' skill level, and provide students with basic field operation skills for the future UAV surveying and mapping work.

2.6 Reconstructing learning initiative through theoretical and practical teaching

In UAV practical teaching, due to the difference between the equipment and the traditional practical training equipment, the angles of the photos and videos taken have the perspective of God, and the results of practical training come from the photos and videos but are presented in completely different forms. Is it possible to stimulate students' interest in learning and reconstruct their learning concepts through the learning process transmitted by teachers? Internalize students' learning motivation and stimulate students' thinking activities, so that students are interested in their own major, can devote themselves to some subjects in the learning process, can effectively use textbooks, networks, norms, product manuals and other comprehensive and effective information to solve various practical problems encountered in daily work, and can make judgments on the reliability of results and conclusions. Gradually transform into a love of learning, love of thinking, can solve problems of the enterprise qualified staff. This is the most far-reaching and meaningful impact on the long-term development of students in the process of theoretical teaching and practical teaching.

3. Concluding remarks

Through the above links, the new technology of UAV surveying and mapping is effectively introduced into the non-surveying and mapping related majors offering engineering surveying courses, so as to contact the new technology of surveying and mapping and understand the new dynamics of surveying and mapping during the school period. And can effectively broaden the students' horizon, from the traditional surveying technology, GPS based modern surveying technology and UAV as the main carrier of surveying and mapping new technology, their respective advantages and disadvantages, understand and master the various surveying and mapping technology in different application fields are not substitutable; To understand and master the differences and similarities between different surveying and mapping technologies in the process of solving the same problem and different technical routes.

Through the addition of new content, teachers are forced to constantly learn and master new knowledge and new technology. Think about how to safely and effectively introduce content into the class, and make students master the most basic knowledge through limited class hours, and constantly iterate, explore and reflect, so as to improve the quality of teaching.

With the continuous development of UAV equipment, "UAV +" will have a profound impact on most of the field data acquisition, monitoring, inspection and other operations, which can greatly reduce the labor intensity of field data acquisition and other work, and reduce the field work time. According to the training orientation of higher vocational talents, it is necessary for non-surveying and mapping students of civil engineering in higher vocational colleges to learn and master this work skill.

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