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Based on “Online+Offline” and “Virtual+Reality” Research on Unmanned Organization Teaching Model

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Abstract: Experimental courses are an important part of cultivating talents in drone application technology, and drone assembly courses are a highly practical discipline. This article proposes to construct an experimental course teaching model of “online+offline” and “virtual+reality”, which can effectively solve the contradiction of insufficient drone equipment resources and slow equipment updates in schools, and also provide reference for the teaching reform of drone related majors.

Keywords: Drone assembly; Experimental courses; Teaching mode; Teaching reform

1. Introduction

The drone experiment course is an important part of cultivating drone application technology talents. As a multidisciplinary emerging technology, it has emerged as a course. However, currently many practical training conditions, especially modern information technology teaching facilities, cannot meet the requirements of ensuring the training goals of equipment talents. Currently, there are the following issues in practical training:

(1) Insufficient practical training equipment. The cost of drone technology equipment is relatively high, and the investment in laboratories in universities is limited. However, the iteration speed of emerging technologies is fast. Therefore, the construction of drone laboratories is relatively backward, and the number and performance of drone equipment cannot meet the needs of offline experiments. The training time for students is short, and the effect of cultivating their hands-on ability is poor.

(2) Drone models vary, and the equipment models equipped for drone specialties are limited. In practice, they cannot be comprehensive, and teaching other models is still limited to theoretical teaching, deviating from the goal of talent cultivation.

(3) The drone training environment is disconnected from the actual environment. The requirements for drone training environment are strict. Simple field training is disconnected from the real training environment, and there are safety hazards in the real environment. Ideal training venues that ensure both training safety and authenticity are very scarce.

A new integrated teaching model that combines full process virtual simulation and practical operation to simulate and simulate theoretical knowledge and realistic practical teaching is adopted, enabling students to master theoretical knowledge, assembly and maintenance skills during the simulation process; The use of flipped classroom and blended online and offline teaching in teaching enables students to develop their ability for self-directed learning, laying a foundation for their sustainable development; Simultaneously achieving the goal of improving the quality of talent cultivation.

2. Construction of project-based teaching method based on virtual simulation and flipped classroom

2.1 Resource construction

Relying on the advanced means of "Internet plus" and the concept of "co construction and sharing", actively explore the construction of professional resources, mainly including hardware and software.

Hardware resources mainly include:

(1) Smart Classroom. Configure smart blackboards, wide-angle cameras, computers and networks, online teaching software, video recording software, smart terminals required for teaching, etc., for teaching reform experiments and high-quality course recording.

(2) Data Resource Sharing Center. Configure high-performance and high-capacity servers for the storage and management of teaching resources and teaching archives, providing stable data resources for online teaching and virtual teaching and research room operations.

(3) Drone Basic Training Room. Configure and assemble drone tools and materials, and equip basic drone models such as F450 to meet the practical needs of students.

Software resources mainly include:

(1) Virtual simulation software construction. Utilize 3D modeling software such as Cinema 4D to construct a drone 3D model, and combine it with Unity 3D to achieve dynamic assembly and interactive control of drones, meeting the assembly requirements of F450 and other aircraft models.

(2) Construction of teaching resource library. By collecting online resources and independently designing and producing, relying on online teaching platforms such as "Chaoxing", we will establish online course resources that integrate text, images, videos, animations, and 3D models with rich teaching forms.

2.2 Flipped classroom teaching mode combining online and offline teaching

The architecture of the unmanned aerial vehicle (UAV) aerial survey experiment course based on "online+offline" and "virtual+reality" (as shown in Figure 1) is based on course data, with a learning platform as the core, targeting teachers and students. The front-end of the learning platform is a different venue for teaching activities, divided into two parts: offline classroom and online classroom. The offline classroom includes traditional offline classrooms and laboratories, and an immersive virtual simulation operation laboratory is established based on VR and AR technology. The offline classroom is the main venue for in class learning; Online classrooms include online course platforms and virtual simulation experiment platforms. Online classrooms are learning places used for preview, consolidation, and testing before and after implementing course teaching and experimental training. The rich front-end platform provides teachers with various teaching methods and also provides students with various learning paths, extending the classroom from the real world to the online world, extending effective learning time from in class to before and after class, and expanding the limitations of practical training to infinity. The backend of the learning platform is a process tracking learning evaluation system based on artificial intelligence technology. By establishing a big data analysis model, it comprehensively analyzes students' mastery of drone aerial survey technology, and conducts scientific academic ability assessment.

3. Implementation and evaluation of project-based teaching method based on “online+offline” and “virtual+reality” flipped classroom

Taking the quadcopter drone assembly and debugging course in vocational colleges as an example, based on the simulation training system and real equipment in the drone training room. The specific teaching process can be planned as: online theoretical knowledge preview - offline theoretical teaching - simulation experiment training - offline practical training - teaching evaluation and feedback.

(1) Online pre class preview. Learn through online course platforms in online classrooms, preview basic drone flight control knowledge through teaching courseware and videos, and test the effectiveness of online learning through knowledge tests.

(2) Offline classroom teaching. This stage is completed in an offline classroom, which includes face-to-face teaching, interaction, questioning, and other activities to solve students' questions in online learning. Emphasis is placed on the knowledge points, training essentials, and safety issues in basic drone flight motion control;

(3) Simulated simulation experiment learning. At this stage, a virtual simulation experimental platform is used to understand the process and content of experimental training through 3D animation, familiarize oneself with drone equipment and structures through 3D models, master experimental steps and key operations through virtual simulation training, strengthen experimental operations, and lay a foundation for conducting field training;

(4) Offline practical training. This stage is in a real training scenario, where the teacher guides students to personally operate the drone to complete the prescribed basic flight action training;

(5) Teaching evaluation and feedback. In this stage, a comprehensive evaluation of academic performance will be conducted based on the learning performance and training results of middle school students in the first five stages. Academic performance in online and offline virtual simulation systems will be automatically calculated based on learning time, test results, experimental error rates, and other data. Academic performance in offline classrooms and practical training will be calculated by teachers based on quantitative indicators of student performance and input into the system, and the system will calculate the results based on the indicator evaluation system.

4. Conclusion

The drone industry is an emerging high-tech industry that involves various fields from research and development, manufacturing, usage, management, and services. At present, it has been widely set up in colleges and universities. Combining "Internet plus simulation technology" with traditional teaching methods, and innovating the hybrid teaching of "online+offline" and "virtual+reality" is an optimization strategy to give full play to the advantages of various teaching means, realize the combination of virtual and real, optimize and innovate the existing

teaching model, which can improve the quality of talent training, lay the foundation for the sustainable development of students, and have strong practical reference significance for the teaching reform of colleges and universities.

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