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# Exploration on the Reform of UAV Technology Talent Training Mode under the Background of Emerging Engineering Education

-- Taking the hybrid teaching mode of "Multi-rotor UAV Technology and Control" course as an example

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**Abstract:** Hybrid teaching represents a crucial innovative pathway in the field of higher engineering education to address global digital challenges. Within the framework of emerging engineering talent cultivation, the deep integration of hybrid teaching and curriculum ideology and politics can fully integrate the cutting-edge nature of online resources with the practicality of offline teaching, thereby enhancing the cultivation quality of applied talents in the UAV technology field. As a core course for cultivating UAV engineering talents, "Multi-rotor UAV Technology and Control" aims at the pain points of the current course in terms of the complexity of the knowledge system, practical skill development, and engineering ethics education. Based on the Outcomes-Based Education (OBE) concept and Problem-Based Learning (PBL) model, this paper systematically reforms the course by constructing teaching case banks, ideology and politics case banks, implementing online-offline integrated teaching (O2O), and establishing a full-process evaluation system, providing a practical paradigm for the cultivation of UAV technology talents under the emerging engineering background.

**Keywords:** Emerging Engineering, UAV Technology, Multi-rotor UAV, Teaching Reform, Curriculum Ideology and Politics.

## 1. Introduction

Under the guidance of emerging engineering construction, cultivating high-quality talents with interdisciplinary knowledge and practical capabilities has become a necessary path for talent cultivation and disciplinary development in national major strategic fields [1]. UAV application technology plays a significant role in emerging engineering talent cultivation, mainly aiming to cultivate talents with capabilities in UAV operation, maintenance, and R&D, enabling them to carry out innovative R&D and technological applications in fields such as logistics, surveying and mapping, agriculture, and security, adapt to industry development needs, and possess teamwork and complex problem-solving abilities. With the rapid development and widespread application of UAV technology, the "Multi-rotor UAV Technology and Control" course, as an indispensable part of UAV application technology professional education, plays a vital role in cultivating comprehensive UAV application technology talents. However, current teaching faces issues such as the disconnection between theoretical teaching and practice, insufficient student operational skills, and single teaching methods. Therefore, exploring a hybrid teaching mode that combines online resources with offline practice has become the key to improving curriculum teaching quality.

In recent years, against the backdrop of the Ministry of Education's vigorous promotion of "Golden Course" construction and "Emerging Engineering" construction, and with the advancement of network technology and the arrival of the information age, hybrid teaching, as an innovative teaching mode integrating online platforms with offline courses based on new teaching concepts [2-3], can fully leverage the advantages of "Internet +" information technology and the flexibility of interactive teaching, breaking down existing knowledge barriers for in-depth teaching and advancing the reform process of talent cultivation in UAV application technology. Meanwhile, fostering morality and cultivating people represent the fundamental task of higher education, and curriculum ideology and politics constitute the theme of the new era. Effectively integrating curriculum ideology and politics elements into the online-offline hybrid teaching process of the "Multi-rotor UAV Technology and Control" course holds important practical significance for enhancing college students' comprehensive quality.

## 2. Analysis of Curriculum Teaching Content and Teaching Mode

The "Multi-rotor UAV Technology and Control" course mainly consists of sections such as an overview of UAVs, UAV classification, UAV aerodynamics, UAV development history, UAV composition and structure, and flight operation practice. It primarily explores the definition, classification, flight principles, development process, and composition structure of UAVs, and requires students to master the flight operation skills of quad-rotor UAVs. Currently, an increasing number of disciplines have begun to attach importance to the study of UAV technology and control courses, which not only serve as key basic courses in the cultivation of UAV application technology-related majors but also cover multiple engineering disciplines. As a highly important course in cultivating UAV application technology talents, the role of the "Multi-rotor UAV Technology and Control" course is mainly reflected in the following aspects: (1) Basic theoretical support: It primarily studies the definition, classification, flight principles, development history, and composition

structure of UAVs, providing students with a solid theoretical foundation. Students can understand the basic composition and working principles of UAVs, laying a solid foundation for subsequent learning and research in UAV application technology.

(2) Engineering application guidance: Knowledge of UAV technology and control provides guidance for engineering practices in UAV application technology. Students can understand the application methods and technical requirements of UAVs in different fields, helping them design and optimize UAV systems and flight plans in engineering practices.

(3) Flight operation skill development: Through practical teaching, students can master the flight operation skills of quad-rotor UAVs, including circle and figure-eight flight contents in CAAC assessments, providing necessary skill support for their future work related to UAVs.

While the demand for talent cultivation in UAV application technology is growing, the course currently faces urgent problems in teaching: First, the "Multi-rotor UAV Technology and Control" course involves a complex knowledge system, with many students having a shallow understanding of UAV theoretical knowledge and struggling to apply it flexibly. Second, the lack of practical links leaves students short of hands-on experience, which is particularly crucial in the UAV application technology field, resulting in their lack of necessary skills when entering the workforce. Finally, the monotony of teaching methods limits students' active learning and innovative thinking. Therefore, the course urgently needs teaching reform, exploring new hybrid teaching models, introducing more interactive and practice-oriented teaching strategies, stimulating students' learning enthusiasm, and fully exploiting the convenience of online courses in subject frontiers and the efficiency of offline courses in knowledge transmission.

# 3. Innovation of Teaching Mode

## 3.1. Innovative Ideas

The Outcomes-Based Education (OBE) concept, that is, outcomes-based education, is a widely adopted education model in the current international engineering education professional accreditation system. OBE follows the principle of "reverse design, forward support," focusing on the concept of "student-centered, outcome-oriented, and continuous improvement," to stimulate students' subjective initiative and maximize their learning enthusiasm and initiative [4]. Problem-Based Learning (PBL), namely problem-based learning, advocates a student-centered approach with problems as the guide, where teachers transform from leading roles to learning supervisors in the teaching process, guiding students to acquire problem-solving abilities through autonomous exploration, group collaboration, and other means. The PBL model fully aligns with the OBE concept. Implementing the OBE concept and PBL model throughout the entire teaching process of the "Multi-rotor UAV Technology and Control" course reform can further cultivate talents with interdisciplinary vision and comprehensive capabilities. In the early teaching process of the "Multi-rotor UAV Technology and Control" course, there were issues such as the disconnection between course content and practical applications, insufficient experimental and practical opportunities, and insufficient emphasis on cultivating innovative and research capabilities. Therefore, further teaching reforms in the three dimensions of knowledge, ability, and values can achieve a comprehensive improvement in "Multi-rotor UAV Technology and Control" education, cultivating high-quality UAV application technology talents that meet social needs, possess innovative spirit, and have international competitiveness. Specifically:

(1) Knowledge transmission: On the basis of traditional core contents such as UAV definition, classification, aerodynamics, and development history, introduce the latest UAV technological advancements and application cases, covering UAV application knowledge in fields such as logistics, surveying and mapping, agriculture, and security. Meanwhile, carry out interdisciplinary integration of UAV technology and control with other disciplines such as physics, mathematics, and computer science to expand students' disciplinary vision and comprehensive application capabilitie.

(2) Ability development: Focus on cultivating students' UAV assembly, debugging, flight operation, and data analysis capabilities, enabling them to independently develop and implement UAV application projects. Additionally, encourage students to undergo scientific thinking training and innovative thinking, stimulating their potential to propose new viewpoints and methods in the field of UAV technology and control.

(3) Value guidance: UAV technology and control are closely related to national security and economic development. Emphasize the social value and application significance of UAV technology and control education, and cultivate students' sense of social responsibility and scientific ethics.

## 3.2. Innovative Measures

### 3.2.1. Construction of Teaching Cases

In the reform of the "Multi-rotor UAV Technology and Control" course, constructing teaching cases represents an important innovative measure. Traditional UAV technology and control teaching often focuses on theoretical knowledge indoctrination, lacking integration with practical applications, which easily leads to students' difficulties and loss of interest. By constructing teaching cases, however, it is possible to combine UAV theoretical knowledge with practical problems, stimulating students' learning interest and enhancing their learning initiative and participation.

### 3.2.2. Introduction of High-quality Teaching Resources

Introducing high-quality teaching resources in the reform of the "Multi-rotor UAV Technology and Control" course represents a key step in improving teaching quality and student learning outcomes. These resources include digital textbooks, online education platforms, scientific research literature, experimental teaching resources, case studies, and academic conferences. This course has introduced the national high-quality online open course Introduction to UAV Design from Nanjing University of Aeronautics and Astronautics, led by Professor Ang Haisong, which covers various aspects of UAV technology and applications and is accompanied by rich multimedia materials. The introduction of these resources has enriched teaching content, enhanced the flexibility and depth of student learning, and stimulated students' learning interest while cultivating their practical abilities. Additionally, foreign universities have accumulated mature hybrid teaching models for UAV technology and control through years of development. This course has also introduced Introduction to Drones launched by the Massachusetts Institute of Technology on the edX platform in

relevant chapters, taught by Professors John Doe and Jane Smith, which deeply introduces core concepts such as UAV flight principles, control systems, and sensor technology, accompanied by high-quality video explanations and quizzes. It should be noted, however, that due to different national conditions and social development stages, many foreign UAV technology and control courses are positioned according to their countries' talent needs and respective universities' disciplinary advantages, which may experience "inadaptability" when directly applied in China's higher education. Therefore, while learning from them, it is necessary to further reasonably restructure foreign course content, integrate knowledge and skills, and ultimately achieve the goal of cultivating interdisciplinary and comprehensive talents.

When introducing these high-quality teaching resources, teachers carefully screen and design them to ensure accurate and authoritative content that matches course objectives and student needs. In recent years, students' autonomous learning abilities and information literacy have generally improved, mainly reflected in:

(1) Increased study time: Surveys show that students' weekly self-study time has increased from 5 hours to 8 hours, indicating their more active participation in learning.

(2) Literature retrieval capabilities: Students' abilities in literature review and analysis in information retrieval courses have improved, with approximately 70% of students able to effectively locate and utilize relevant scientific research literature.

(3) Course feedback surveys: In feedback on new resources, over 80% of students indicated that the newly introduced resources helped them understand course content and stimulated their learning interest.

### 3.2.3. Online-offline Hybrid Teaching

The teaching mode is a stable teaching activity procedure and structural framework established under the guidance of rich teaching theories, which can not only reflect educators' teaching concepts but also influence students' learning outcomes [5]. In recent years, with the advancement of network technology and the arrival of the information age, O2O (Online To Offline) teaching has gradually become an engine driving teaching mode reform. Originating from the United States, practice has shown that hybrid teaching can change students' cognitive styles and improve their learning outcomes [6]. Choosing appropriate digital teaching tools to organically combine internet technology with offline teaching allows students to obtain broad learning spaces from online platforms while offline teaching provides opportunities for face-to-face communication and question-answering between teachers and students, enabling students to engage in deep hybrid learning, thereby achieving value guidance while cultivating students' abilities and imparting knowledge.

(1) Online Teaching Phase: Building a Diversified Network Platform

Online teaching refers to teachers providing online teaching resources for students through network platforms. In the online teaching phase of the "Multi-rotor UAV Technology and Control" course, teachers can release learning announcements and discussion topics on the Yangtze Rain Classroom according to the curriculum teaching design and upload preview resources such as micro-lecture videos and auxiliary teaching materials. Online preview demonstrates significant spatial and temporal advantages, allowing students to independently arrange time to complete preview content item by item, enhancing their learning enthusiasm and autonomy and fully reflecting personalized teaching.

In addition, the online teaching phase also includes after-class consolidation exercises. After-class consolidation combines traditional exercises with open questions. Traditional exercises include noun explanations, multiple-choice questions, and fill-in-the-blank questions, helping students consolidate professional knowledge. Open questions mainly involve case analysis, and designing cases by integrating social practical problems with professional knowledge can better cultivate students' innovative thinking and interdisciplinary vision.

(2) Offline Teaching Phase: Cultivating Engineering Innovative Thinking

The offline teaching phase refers to face-to-face classroom teaching. Different from traditional single teaching models, teachers can adopt teaching methods such as backward teaching and flipped classroom teaching models that integrate the PBL model and OBE concept in offline teaching. In theoretical teaching, the PBL model is adopted, with the problem-oriented approach of "insufficient UAV endurance," guiding students to deeply analyze power system defects and stimulating students' active thinking and problem-solving abilities through group discussions and teacher guidance. This teaching method enables students to learn to analyze problems from multiple perspectives and propose solutions when facing practical issues, cultivating their logical thinking and teamwork abilities.

In practical classes, group flight training is adopted. Teachers observe students' operations in real time and correct mistakes promptly to ensure students master the correct flight skills. Meanwhile, practical teaching is combined with competition activities, such as organizing "fault elimination" competitions, like simulating emergency handling when the remote control fails. Through competition, not only does it enhance students' interest and enthusiasm for learning, but it also improves their adaptability in emergency situations. Additionally, the practical teaching phase encourages students to form teams on their own, design practical plans, and complete operations and data processing, further fostering their innovative awareness and practical abilities. This diversified teaching model, which combines theory with practice, provides students with a broader learning space and development opportunities, helping to cultivate drone technology talents with stronger innovation and practical abilities.

### 3.2.4. Process-oriented Teaching Design

With the advent of the Internet era, the development of electronic information technology has provided opportunities for the cultivation of new engineering talents. The content of the "Multi-Rotor Unmanned Aerial Vehicle Technology and Control" course is relatively saturated, so the importance of process-oriented teaching design cannot be ignored. It is necessary to clarify the logic and steps of knowledge transmission and reflect the process-oriented nature of teaching design in the order of "before class - in class - after class". At the same time, the two teaching links included in the O2O blended teaching, namely the online teaching link and the offline teaching link, can run through the three stages of before class, in class and after class, as shown in Figure 2. In the "before class" stage, teachers can guide students to preview the upcoming learning content by assigning preview tasks or providing relevant materials, thereby stimulating

their interest in learning. In the "in class" stage, teachers can combine various teaching methods such as explanations, case analyses and discussions to guide students to deeply understand the knowledge of unmanned aerial vehicle technology and control, and deepen their learning impression through practical operations or group cooperation. In the "after class" stage, teachers can help students consolidate the knowledge they have learned and promote the application and extension of knowledge by designing homework, practical reports or extracurricular reading tasks. Through this process-oriented teaching design, the teaching content of this course becomes more systematic and organic, which is conducive to improving students' learning outcomes and depth.

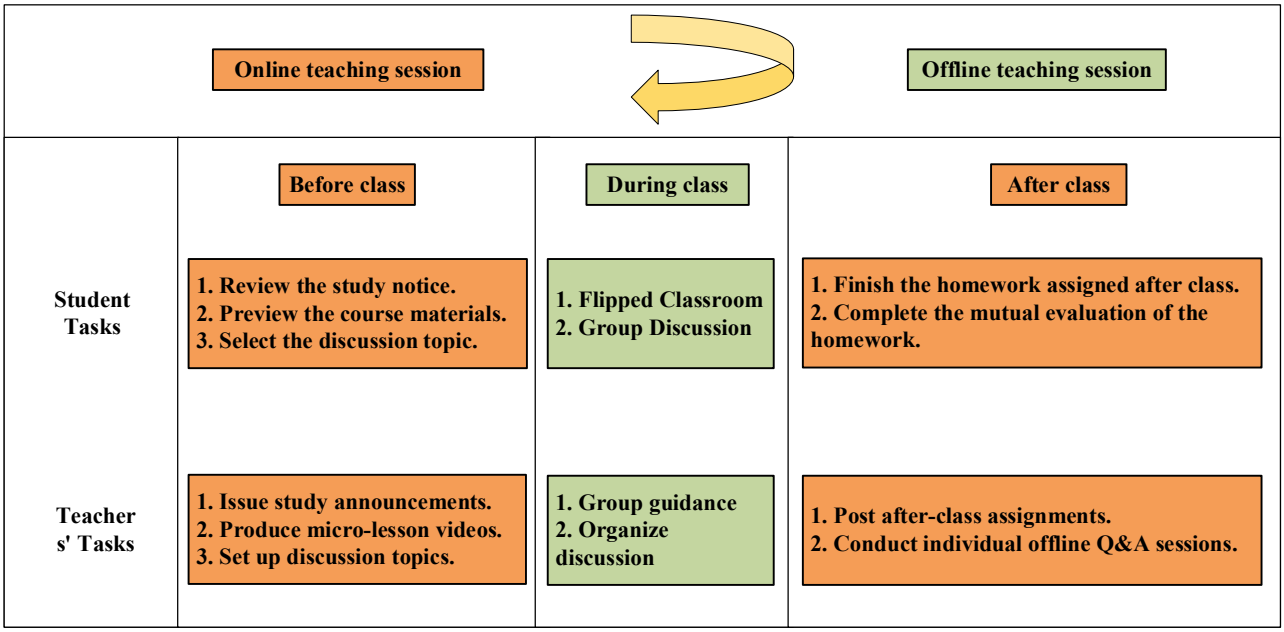


**Fig. 1** Blended teaching organization model

### 3.2.5. Full-Process Teaching Evaluation

In 2020, the Overall Plan for Deepening the Reform of Education Evaluation in the New Era issued by the Central Committee of the Communist Party of China and the State Council proposed reform requirements for student performance assessment methods, namely, eliminating the practice of labeling students solely with scores and further improving the comprehensive quality evaluation system by adopting reformative process-oriented evaluation methods. Therefore, for the "online + offline" hybrid teaching mode of the "Multi-rotor UAV Technology and Control" course, this course adopts an overall evaluation approach combining process-oriented evaluation and summative evaluation, integrating subjective and objective evaluations, as well as a diversified assessment system that incorporates students' ideological standards and political awareness. The specific evaluation rules are shown in Table 1:

**Table 1.** Course academic achievement evaluation scheme

| The purpose of the assessment | Evaluation method | Evaluation components | | Weight/% |
|---|---|---|---|---|
| Learning outcome | Process-based assessment | Offline learning situation | Attendance record | 5 |
| | | | Group discussion | 10 |
| | | | Mid-term test | 10 |
| | | Online learning situation | Video viewing duration | 5 |
| | | | Case Discussion | 10 |
| | | | Chapter Test | 10 |
| | Periodic assessment | Mid-term exam | | 20 |
| | Final assessment | Final exam/test | | 30 |

### 3.2.6. Construction of Ideology and Politics Case Bank

In recent years, institutions of higher learning have continuously promoted the implementation of the Guiding Outline for Curriculum Ideology and Politics Construction in Higher Education Institutions. As a new educational concept, curriculum ideology and politics uses courses as platforms to combine explicit and implicit education, adhere to the fundamental task of fostering morality and cultivating people, and achieve the educational concept of value guidance in knowledge dissemination [7]. The integration of curriculum ideology and politics with hybrid teaching has gradually become a trend and hotspot in the teaching reform field. As a curriculum system closely related to national security and economic development, the "Multi-rotor UAV Technology and Control" course contains rich ideology and politics themes, making the development of curriculum ideology and politics an important part of curriculum construction. Using various teaching methods and setting diverse activities to carry out full-process curriculum ideology and politics in all teaching links, as shown in Table 2, can better mobilize students' learning enthusiasm and allow ideological and political education to influence students like a gentle spring breeze.

**Table 2.** Design of Curriculum Ideology and Politics Elements

| Teaching content points | Ideological and Political Content | Ideological and Political Case Studies |
|---|---|---|
| The development history of unmanned aircraft | National scientific and technological development and independent innovation | The development process of China's unmanned aerial vehicle technology, from scratch to strength, from weakness to superiority. |
| The composition structure of the unmanned aerial vehicle | Teamwork and Engineering Ethics | The collaboration of the quadcopter drone research team also involves ethical issues |
| The operation of unmanned aircraft flying | Safety awareness and social responsibility | Safety regulations in drone flight operations and their impact on society |
| The application fields of unmanned aircraft | Science and technology innovation and social development | The application of unmanned aerial vehicles in fields such as logistics, mapping, agriculture, and security has a significant impact on social development. |

# 4. Conclusion

The application of UAV application technology is becoming increasingly widespread in fields such as logistics, surveying and mapping, agriculture, and security. Cultivating high-end UAV application technology talents who master advanced UAV technology and uphold the concept of sustainable development is crucial to gaining the initiative in future international competitions. Institutions of higher learning are the key converging points of the three major national strategies of talent, technology, and education, serving as fundamental and strategic supports for building a modern socialist country in all respects. Against the backdrop of emerging engineering education and combined with interdisciplinary characteristics, the teaching of the "Multi-rotor UAV Technology and Control" course urgently needs to advance the reform process, improve teaching methods, and update teaching models and curriculum evaluation systems. Integrating new teaching concepts such as the PBL model and OBE philosophy into the O2O hybrid teaching model can achieve value guidance in the process of cultivating students' abilities and imparting knowledge, while enhancing students' understanding and mastery of knowledge. At the same time, it also plays a positive guiding role in educating students on moral character and political identity, laying a solid foundation for the cultivation of future engineering literacy.

# References


[1] Gu Shixian, He Peixin, Qiao Jie. Thoughts and Prospects on the Cultivation of Interdisciplinary Medical-Engineering Talents in the New Era [J]. Research on Science and Education Development, 2022(3): 19-35.

[2] Wang Xue. Discussion on the Online-Offline Hybrid Teaching Mode of Chemical Principles Experiment in the New Engineering Era [J]. Chemical Fiber & Textile Technology, 2023, 52(12): 211-213.

[3] Xu Yunfeng, Chen Junliang, Fei Peng, et al. Exploration and Implications of Food Chemistry Teaching Reform Based on MOOC in the Context of New Engineering Education [J]. Food and Fermentation Technology, 2021, 57(3): 4.

[4] Zhang Airan, Yao Liyou, Zhang Yuanping, et al. Reform and Practice of Hybrid Teaching Based on SPOC under the OBE Concept [J]. Journal of Shanxi Datong University: Natural Science Edition, 2023, 39(1): 111-115.

[5] Wang Wenjing. Practical Exploration of Teaching Model Reform in China - The "Learning-Oriented" Comprehensive Classroom Teaching Model [J]. Journal of Beijing Normal University (Social Sciences Edition), 2012(1): 18-24.

[6] Zhu Yifan, Yang Changjun, Xue Mingwei, et al. Design and Exploration of O2O Information-Based Teaching Model in University Classrooms [J]. 2021(2020-18): 6-11.

[7] Yang Luming, Ran Shiyao, Xu Yalin, et al. "Exploring the 'Course Ideological Education' for Postgraduate Students in Leather Chemistry and Engineering Discipline under the Background of 'New Engineering Education' [J]. Leather Science and Engineering, 2020, 30(4): 4.