

Research on Teaching Methods of Flight Control Principles

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Abstract: With the rapid development of China's civil aviation industry, the teaching method of operating knowledge of flight principles has changed greatly, which creates a good implementation environment to improve the safety of civil aviation in our country. At present, the main training content of air route transport pilots in China is basic aviation theory, initial flight training, airline modification, etc. The principles of flight control are an important part of basic aviation theoretical knowledge training, which will involve a large number of flight technology training content, instructors will also be based on the pilot type. Teaching flight control theory and practical knowledge requires relatively high theoretical learning ability of students, and the learning effect of this part of theoretical knowledge will directly affect the quality of subsequent learning, but also directly affect the effectiveness of flight training. This paper focuses on the analysis of the basic concepts of flight control, studies the existing problems in the teaching of flight control principles, summarizes the teaching measures of flight control principles, aiming to provide a reference to teaching personnel.

Keywords: Flight control principle knowledge; Virtual simulation; Teaching method

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1. Introduction

Safety has always been the basic condition for the development of the aviation industry, but also the main direction of flight school teaching, especially for the training of civil aviation flight personnel, but also for the development of China's civil aviation industry to train high-quality personnel. Through the analysis of the main flight safety accidents, it is found that a large part of the cause is caused by the human factors of the pilots, which has a great impact on the development of civil aviation. This requires comprehensively improving the professionalism of pilots and reducing the impact of human factors on the development of aviation. Flight college should strengthen the training of students' theoretical and practical application ability according to the needs of air transportation safety production management so that students can systematically understand the flight principle and operation knowledge, lay a good theoretical and practical foundation for the future development of students, and ensure the stable development of China's aviation industry.

2. Basic concepts of flight control principles

The flight control principle course is a crucial component of the aviation theory teaching system and a significant part of the civil aviation flight license examination. Students need a deep understanding of flight control principles and must enhance their theoretical knowledge to successfully obtain a flight license. The course primarily covers subjects such as aerodynamics and flight dynamics. When teaching flight control principles in college, it is essential to systematically explain theoretical knowledge and help students understand its application through classroom simulations. Mastery of flight control principles improves students' flight judgment abilities, enabling them to effectively address abnormal situations during flight and reducing the likelihood of flight safety incidents. Aviation colleges should strengthen the teaching of flight control principles to ensure that students can flexibly master and apply this knowledge, laying a solid foundation for subsequent training tasks. Additionally, aviation colleges should optimize and innovate the teaching methods for flight control principles, enhancing the integration of theoretical and practical teaching. This approach will help students clearly understand the application scenarios and methods of flight control principles, comprehensively improving the quality of flight personnel training. Creating a conducive environment for the safe and stable development of China's aviation industry requires a comprehensive enhancement of flight control principle teaching ^[1-3].

3. Main problems in traditional flight control principle courses

The teaching of flight control knowledge is always an important part of pilot training, but the following problems exist in traditional classroom teaching.

3.1. Lack of perfect classroom application scenarios

Flight control principle teaching is not merely a theoretical course; it requires substantial hands-on experience, particularly with aircraft instruments. Students must master instrument operation skills based on textbook content rather than just understanding the main application scenarios and structures from the textbook. Traditional classroom teaching of flight principles often lacks practical operation components. Due to the complex weather and terrain conditions in the sky, aircraft maneuverability varies significantly under different circumstances. However, traditional classroom teaching on flight principles often lacks training for complex weather conditions, limiting exercises to good weather scenarios. This shortcoming prevents the full scope of flight principle maneuverability from being demonstrated. As a result, students may struggle to effectively improve their flight control skills. Encountering complex weather conditions can lead to control errors, posing significant risks to flight safety. Therefore, it is crucial to incorporate practical operation teaching and simulations of complex weather conditions into the flight control principles curriculum to better prepare students for real-world scenarios and ensure safer flights.

3.2. Inadequate credit hours of flight principle maneuvering practice

Through the analysis of flight control principle teaching in domestic colleges, it has been found that some aviation colleges allocate insufficient credit hours for this course. This results in a significant disconnect between theoretical instruction and practical application, making it difficult for students to integrate theory with practice, which hinders their professional development. Additionally, due to the cohesive nature of flight control practice teaching, it is necessary to present various control concepts together. However, students have different levels of understanding of theoretical knowledge, leading to flight control practice teaching often focusing on a single control topic. Consequently, students' comprehensive control skills are somewhat inadequate.

3.3. Inadequate emphasis on teaching safety flight awareness

Flight is not the work of a single pilot; it requires cooperation among all crew members, especially in the complex environment of flight. Crew members must strictly adhere to safety management regulations. Any incorrect control actions by the pilot can directly impact flight safety and potentially cause serious accidents. However, some students fail to recognize the importance of flight control during practical courses on flight principles, which introduces safety risks for future flight operations.

3.4. Failure to highlight the principal position of students

Due to limitations in facilities and funding, some aviation colleges have insufficient flight simulation teaching equipment. High start-up and maintenance costs further limit the time students can spend on flight simulation training. Additionally, a shortage of flight instructors in some colleges means that many practical flight training tasks cannot be conducted, leading to an overemphasis on theoretical instruction. Moreover, the prolonged classroom learning environment makes it difficult for students to stay focused on flight principles and control knowledge, negatively affecting the overall pilot training effectiveness.

4. Main measures to improve the teaching quality of flight control principle knowledge

4.1. Building a student-centered teaching system

Aviation colleges should build a student-centered teaching system according to the development needs of the aviation industry, aiming to comprehensively improve the quality of flight control education. To achieve this, it is essential to combine theory and practice, allowing students to adapt to flight and operational environments in advance. This involves changing the classroom teaching mode to integrate more theoretical knowledge with hands-on operations, effectively enhancing students' flight control abilities. Flight instructors should analyze the learning progress and outcomes of students to identify gaps in their knowledge. They should cultivate students' rigorous flying habits and calm demeanor by simulating various flight control scenarios in complex environments, with a focus on improving students' emergency response abilities. Instructors should also encourage and guide students in practical research, fostering a mindset of thinking critically, observing, and imitating best practices. Shifting the focus of classroom teaching to enhance students' professional qualities is crucial. Implementing an inspiring teaching mode can help students develop independent thinking skills. Moreover, instructors should summarize and organize the relevant course content according to flight control principles. This approach enables students to integrate flight control knowledge effectively, thereby improving the overall teaching level of flight control principles comprehensively^[4-7].

4.2. Strengthening the application of modern teaching tools

With the rapid advancement of information technology in China, the teaching approach for flight control principles must undergo significant changes. Traditional classroom methods are no longer adequate for effective flight control principles instruction. Aviation colleges should incorporate more virtual simulation teaching equipment to seamlessly integrate theory with practical applications, addressing the current imbalance between theoretical and practical coursework. This approach allows students to engage in more virtual practice sessions, thereby enhancing their learning efficiency in flight control principles. Aviation colleges should also introduce additional information-based teaching equipment and methodologies tailored to the specific requirements of flight control principles instruction. By employing information-based teaching methods across various disciplines, students can gain a deeper understanding of the practical applications of flight control principles. In

addition to existing multimedia teaching systems, aviation colleges can strengthen online and virtual simulation teaching methodologies, fully integrating the flight control principles course with information-based teaching tools. Teachers should continuously optimize and adjust their teaching approaches based on the evolving needs of the course, ensuring that students can effectively grasp flight control principles knowledge^[8-10].

Teachers should leverage the benefits of information-based teaching to tailor instruction to students' individual knowledge levels. Firstly, teachers should conduct thorough assessments of students' understanding of flight control principles. While maintaining the regular teaching schedule, students who struggle to grasp concepts should be encouraged to utilize online resources for additional learning. Conversely, students who progress quickly should be guided to engage in previewing or independent simulation practice. Given the rapid advancements in aircraft technology, aviation colleges should gather more flight control data corresponding to updates in aircraft control systems. This data can be utilized by students during their free time to deepen their understanding of crucial control skills and knowledge. Video teaching can be employed to directly showcase these skills and concepts to students, facilitating both previewing and reviewing and enhancing their learning progress. Furthermore, teachers should compile classic cases of safe flight to underscore the significance of flight control principles for future development. Integrating flight safety into classroom teaching can enhance students' awareness of safe flight practices and promote a culture of safety within the aviation community. Secondly, teachers should promote active classroom participation in aviation colleges by shifting away from traditional single-output teaching methods. Instead, students should engage in virtual simulation exercises aligned with specific control requirements to enhance their understanding of flight and control principles. Aviation colleges should invest in more information teaching equipment, such as virtual simulation technology, to elevate the teaching standards of flight principle manipulation. Virtual simulation technology integrates computer, imaging, simulation, sensing, and artificial intelligence technologies to effectively replicate diverse flight and driving environments. This immersive experience allows students to experience real-flight scenarios and practice flight simulations under complex conditions, thereby enhancing their emergency response abilities. Moreover, the application of virtual simulation technology optimizes practical teaching quality for students while requiring minimal space. Teachers can facilitate synchronous exercises in class according to theoretical teaching requirements, enabling students to familiarize themselves with flight cockpits and real-life applications of flight instruments. Through human-computer interaction, students can experience realistic driving environments, boosting their learning enthusiasm. Aviation colleges should stay abreast of modern flight simulation technology developments and leverage information-based teaching methods to reduce the cost of flight practice instruction. This approach not only cultivates students' proficiency in control techniques but also fosters the development of sound control habits over time.

Lastly, by employing information-based teaching methods, flight simulation on computers becomes possible. This effectively reduces the costs associated with actual flight instruction and helps correct any improper control habits students may have. Additionally, for students struggling with control abilities, teachers can use spare time to enhance their skills, allowing them to quickly grasp flight and control principles. This approach ensures that students develop good flying habits before actual flight experiences and sharpens their driving and control abilities in complex environments. Moreover, organizing different teaching levels within the flight academy aids students in adapting quickly to flight control courses. Clear explanations of flight control circuits enable students to devote more time to control practice, emphasizing key teaching points and laying a solid foundation for their future development^[11-15].

4.3. Stimulating students' interest in theoretical teaching

Flight control principle teaching should extend beyond traditional classroom methods and incorporate the use of flight simulation software for simulation exercises. This allows students to engage in flight control exercises at any time and from any location. Instructors can recommend various flight games to students based on the content available in the flight game market, enabling them to independently practice different maneuvering exercises. Furthermore, instructors can organize students into practice groups, assigning specific roles to each group member. Two-person group exercises can be conducted, allowing students to practice taking on different roles and mastering a wider range of control knowledge. Within the classroom, teachers can organize game drills where different groups engage in simulation exercises and then evaluate their own and each other's performance. Winners of these drills can be appropriately rewarded to encourage excellence. By integrating activities and teaching, students can develop a greater interest in flight principle manipulation and quickly immerse themselves in the learning process. This approach helps students seamlessly integrate into flight principle control learning and enhances their overall understanding and proficiency.

5. Conclusion

The essence of flight control principle teaching lies in practical application. Teachers should establish a student-centered teaching system and emphasize the importance of classroom practice. The focus should be on training students' practical skills, with clear training levels and plans for each student. This approach enhances the practicality and relevance of flight principle manipulation teaching. Additionally, tailored teaching methods should be employed based on students' individual knowledge and practical skill levels to elevate the overall flight control skills of the class. Aviation colleges should increase investment in information teaching equipment to provide students with more realistic virtual control experiences. Enriching the teaching content of flight control principle courses will enhance students' interest in learning and ultimately produce more high-quality flight talents for China's aviation industry.

Disclosure statement

The author declares no conflict of interest.

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