Exploration and Practice Research on the Mixed Teaching Mode of Mechanical and Electrical Technical English in Advanced Vocational Colleges Based on the Mode of "Heterogeneous Classes"

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Abstract. The study of technical English is crucial adjective for students in advanced vocational colleges. It is an important professional course that students must master before graduation. In recent years, with the continuous expansion of the enrollment scale of aircraft maintenance major in our college, the source of students is extensive, but the English foundation is relatively weak. This paper proposes the use of information-based teaching methods based on 'heterogeneous classes', strengthening practical teaching content, and implementing project-based teaching to promote the reform of electromechanical professional English teaching. This method formulates optimization measures according to its development status. It conforms to the development needs of the times to improve students' technical English level, and cultivate more excellent compound skilled talents for the country. It has important practical significance for improving the English level of students majoring in aircraft electromechanical maintenance engineering.

Keywords: mixed teaching mode, technical English, heterogeneous classes, curriculum reform

1. Introduction

Mechanical and electrical technical English is one of the important courses in aircraft electromechanical maintenance specialty. Through the study of technical English, it can promote the cultivation of students ' professional level and comprehensive quality. However, there are some problems in the course orientation and teaching status of technical English[1], which are mainly reflected in students ' lack of understanding of the course, low interest in learning, unreasonable arrangement of course content, single teaching method and so on.

Especially in recent years, with the continuous expansion of the enrollment scale of aircraft maintenance major in our college, the source of students is extensive, but the English foundation is relatively weak. Judging from the recent feedback from the employers of China Eastern Airlines ' order classes, the English level of graduate students, especially the professional English level, is very weak. It is urgent to solve the current situation through the teaching reform of mechanical and electrical professional English.

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Based on this, this paper proposes the use of information-based teaching methods based on ' heterogeneous classes ', strengthening practical teaching content, and implementing project-based teaching to promote the reform of electromechanical professional English teaching. This method formulates optimization measures according to its development status. From the perspective of students, it conforms to the development needs of the times to determine the direction of reform, improve students ' professional English level, and cultivate more excellent compound skilled talents for the country. It has important practical significance for improving the English level of students majoring in aircraft electromechanical maintenance engineering.

2. Research background and current situation

Advanced vocational education is a high-level education in China 's vocational education system, which undertakes the mission of training talents for economic and social construction and development. As the two main types of modern higher education system, advanced vocational education and subject-based general higher education have great differences in many aspects such as the mode, means, ways, methods and purposes of talent training. In advanced vocational education, technical English course is not only a basic course, but also closely related to professional courses. [2-3] Therefore, English teachers in advanced vocational colleges need to start from the actual needs of students ' learning. On one hand, they should pay attention to laying a solid foundation for students ' English learning. On the other hand, they should also meet the requirements of students ' English learning in professional courses[4].

With the development of international economic globalization and integration and the implementation of China 's " Belt and Road " initiative, the state has higher requirements for the English level of professional and technical personnel, including the integration of professional technology and technical English, English communication ability training and so on[5-7]. Therefore, it is urgent to strengthen the English training of professional and technical personnel in the electromechanical industry as soon as possible to cultivate compound talents.

The course of mechanical and electrical technical English is to enable students to understand the English terms and expressions of aircraft structure and the composition, function, main components, faults and other aspects of each system through learning. Students should get the following skills: more skilled access to the English version of the Aircraft Maintenance Manual, Structural Repair Manual, Fault Isolation Manual, etc. They should read and correctly handle daily English business documents such as service announcements, advisory notices, and airworthiness directives and have the ability to read or translate professional English literature related to aircraft maintenance independently.

The current teaching situation is that students ' initiative in autonomous learning is not enough, their participation in classroom teaching and learning is not sufficient, they cannot read relevant manuals and literature content independently, and their ability to learn and master textbooks is insufficient. [8-11] Based on the above status quo, this paper intends to propose a modular hybrid information-based teaching reform and innovation method based on ' heterogeneous classes ', with task guidance as the goal, working group as the organizational form, and problem-solving as the starting point. Starting from reality, lead students from passive acceptance of knowledge to active learning of knowledge. Understand their own differences, increase learning enthusiasm and interest, and improve learning level and effect.

Through the teaching reform practice and innovation of this project, this paper puts forward the innovative method of modular mixed information teaching reform based on ' heterogeneous class '. The teaching of mechanical and electrical technical English should be actively innovated and reformed according to the actual situation of students, so as to promote students to learn technical English knowledge suitable for themselves and the development trend of the industry, and provide professional, high-quality and all-round talents for social development.

3. Research difficulties

3.1 Enhancement of interest in learning

After years of basic education stage of English learning, advanced vocational college students have a certain foundation in English. However, in the study of general English courses, such as ' practical English ' courses, whether it is vocabulary, grammar or syntax, due to the relatively familiar learning content, students have certain learning saturation characteristics, and most students show low learning enthusiasm, which reduces the teaching effect to some extent.[12] The focus of this method is how to stimulate students ' enthusiasm for learning, from passive input to autonomous learning.

3.2 The improvement of technical English foundation

Technical English has the characteristics of limited vocabulary and high frequency of use of technical vocabulary. Students can master a certain number of professional vocabulary through a certain period of study, and basically have the ability to understand the abstract of scientific and technological literature. The sentence expression of technical English is mainly objective description and passive voice, which is quite different from the writing style of general English articles. After students master the classical sentence description, they can better adapt to the reading needs of scientific and technological literature.[13] Of course, the vocabulary and sentence pattern expression of technical English has a certain degree of uncommonness and difficulty. After the training of technical English teaching, students not only improve the language ability of technical learning, but also stimulate the interest and confidence in learning basic English. This is another exploration and practice difficulty of this project.

3.3 Weak basic professional knowledge

The study of technical English is based on certain professional knowledge. Especially for civil aviation electromechanical technical English, students need to learn and master the working principle and working process of aircraft systems in order to understand the unfamiliar meaning of professional English.[14s] However, in the actual teaching, it is found that many students are very weak in the study of professional knowledge. In the actual teaching, it is necessary to reinterpret the professional knowledge, which is undoubtedly another challenge for the limited class hour arrangement.

4. Research methods and Implementation cases

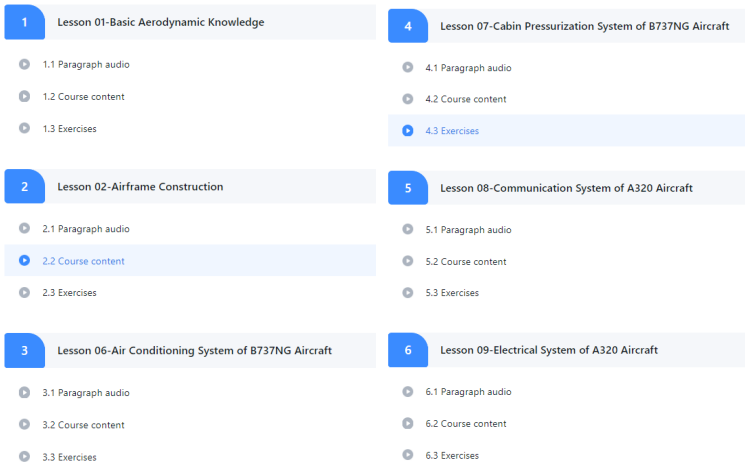
This paper focuses on the practice of information-based teaching reform based on 'heterogeneous classes'. ' heterogeneous classes' mode refers to the classroom mode with differences in classroom process, structure, activity space between teachers and students, teaching methods and effects caused by different teaching styles, methods and learning content conditions of teachers in the same course and the same teaching content. The heterogeneous model of the same course is not only a research topic for the further deepening of the new curriculum reform, but also the object of the exploration of the new curriculum reform and the research on the diversity of teaching methods when the course content is specific to the classroom, or the content of the substantive research on the theory and practice of classroom teaching and the specific reflection of ' teaching method but no fixed method '.

This model is first determined by the basic characteristics of students ' learning, and secondly, it is conducive to teachers ' better understanding of curriculum standards and improving the effectiveness of teaching. Therefore, it is a better means and method for the current situations.

Based on this, we took Mechanical and Electrical Equipment Maintenance class 2241201 and 2241202 as the implementation cases to carry out the proposed mixed teaching mode and the outcomes and comparative analysis of the effectiveness of the new teaching approach in contrast to traditional methods are as follows.

4.1 Teaching contents

In the teaching of these two classes, we adopted 'heterogeneous classes' mixed teaching mode through online learning platform. Based on this, we built the online learning resources of the whole course. Figure 1 shows the online course construction. It is completed on the platform from curriculum management to online and offline classroom teaching. At the same time, the online platform can collect pre-class, in-class and after-class teaching materials, which is convenient for recording students' learning status and collecting learning process evaluation data.



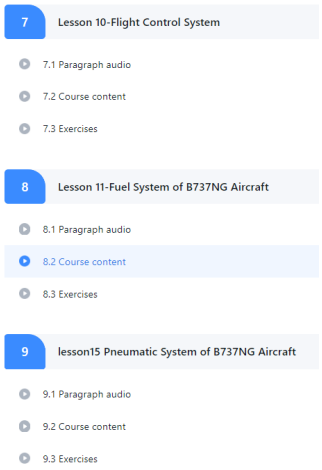


Figure 1 online course construction

As shown in Figure2, 212 students have selected the course and there are 23 assignments, 266 subjects, 117 classroom activities, 16 audio and video course materials, and 315 topics in the discussion area.

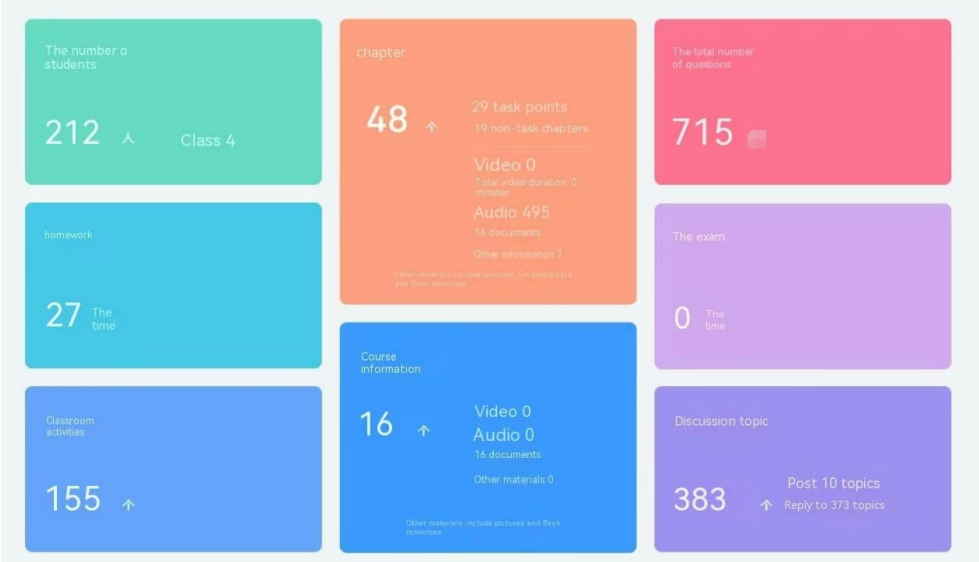


Figure. 2 Online resource construction of blended teaching method

Research results: Through the method of group task division and cooperation, students' participation is increased, and students' interest in learning is improved through the method of inter-group scoring.

4.2 Teaching methods

To explore the blended teaching method based on flipped classroom. The introduction of network terminal evaluation, vocabulary card practice, online learning platform based on learning through the process of evaluation system and other methods to improve the classroom ecology.

For example, exploring the reform of project-based teaching methods based on maintenance work orders. Taking the maintenance task as the modular teaching project, the situational teaching based on the maintenance work order is carried out in the form of group task discussion. This can change the original passive teaching into active learning based on textbook learning. Figure 3 shows the teaching method of group discussion aiming at aircraft maintenance project work order. We present an AMM for disassembling the VHF1 communication panel, requiring students to complete the translation of the manual and the completion of the work card in groups. Figure 4 shows the completion of each group.

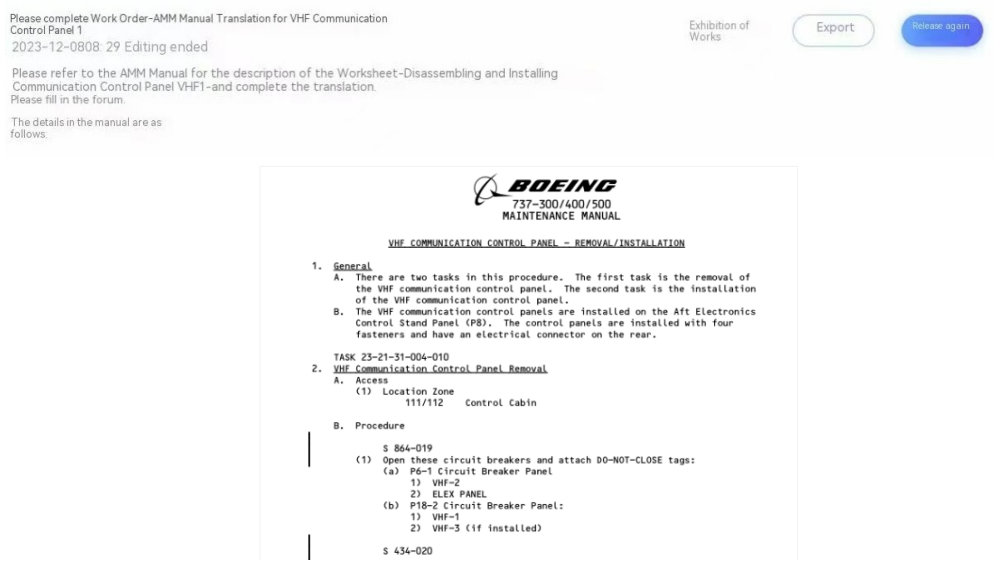


Figure 3. Group discussion task items

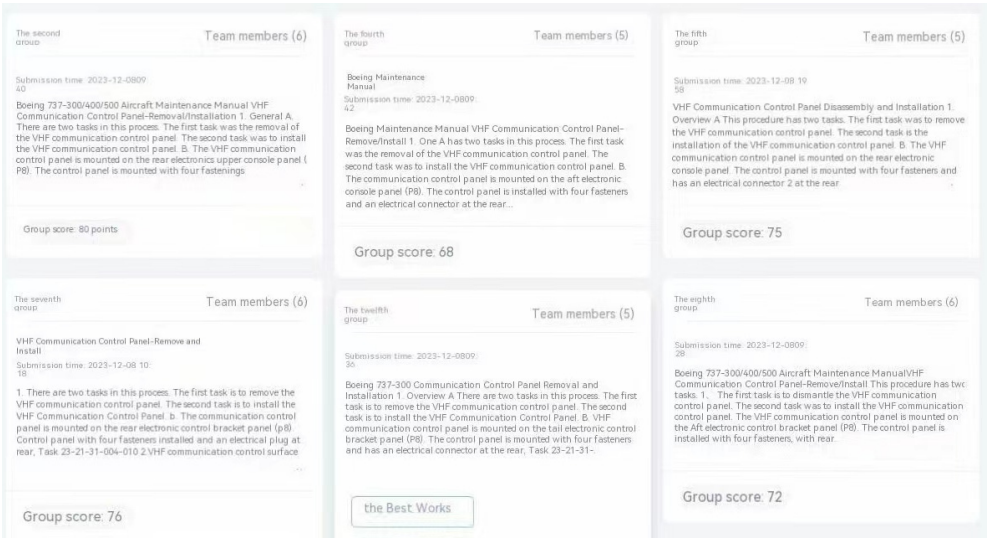


Figure. 4 The completion of each group

This method is based on the use of online and offline hybrid teaching methods. Taking the course on March 5 as an example, Figure 5 shows the attendance rate and average completion rate of homework in this class. Figure 6 shows the online check-in for each class. We use vocabulary card to practice the students' comprehension and memory of vocabularies.

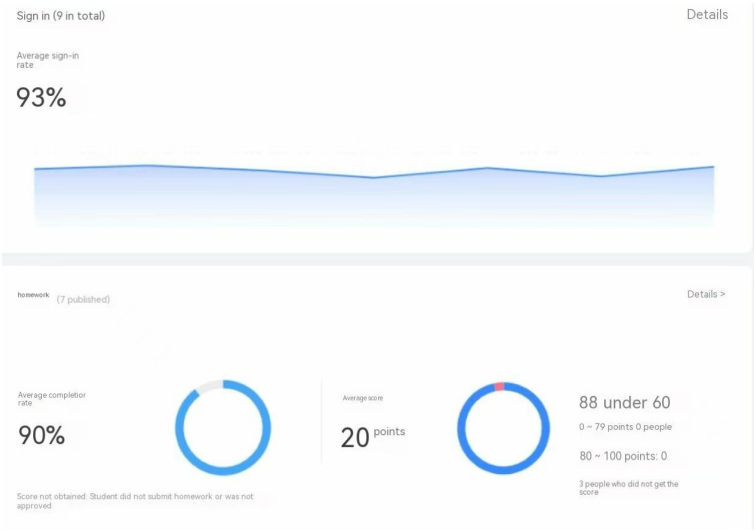


Figure. 5 The attendance rate and average completion rate of homework on March 5' class

Figure 6. Online check-in for each class

This method greatly improves the students ' enthusiasm and participation in class, and the learning state changes from passive input to active output.

4.3 Curriculum ideological and political education

In this paper, we have used the following method to build an ideological and political curriculum:

(1) in-depth excavation of the ideological and political elements of electromechanical professional English courses.

(2) adhere to the principles of comprehensive, accurate, systematic and collaborative, explore the elements of craftsman spirit and scientific innovation,

(3) cultivate students ' patriotic feelings and improve students' professional quality,

(4) explore the elements of international vision, and apply them to teaching practice, so that students are unconsciously guided by value and shaped by soul.

4.4 Outcomes and analysis

We took Mechanical and Electrical Equipment Maintenance class 2241201 and 2241202 as the implementation cases to carry out the proposed mixed teaching mode. In order to verify the effectiveness of the mixed teaching method, we compared the teaching performance of the same class in another semester with the traditional teaching method.

Figure 7 shows the analysis of final exam results and the score histogram which is proposed mixed teaching mode in the second semester of 2022-2023, while Figure 8 shows the analysis of final exam results and the score histogram which is used the traditional teaching method in the first semester of 2023-2024.

Analysis of final exam results 2023-2024（1）

class and grade	2341201-02	90-100	5
Number of examinees	74	80-89	25
percent of pass	93%	70-79	29
average score	72	60-69	22
standard deviation		50-59	3
Number of unqualified	5	<50	2

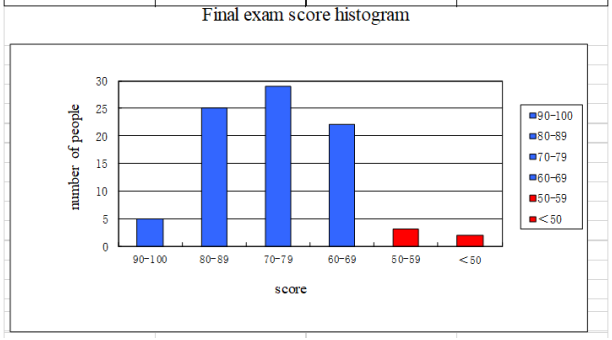


Figure 7. Analysis of final exam results in 2023-2024(1)

Analysis of final exam results 2022-2023（2）

class and grade	2241201-02	90-100	2
number of examinees	72	80-89	10
percent of pass	79%	70-79	18
average score	67	60-69	35
standard deviation		50-59	1
number of unqualified	6	<50	5

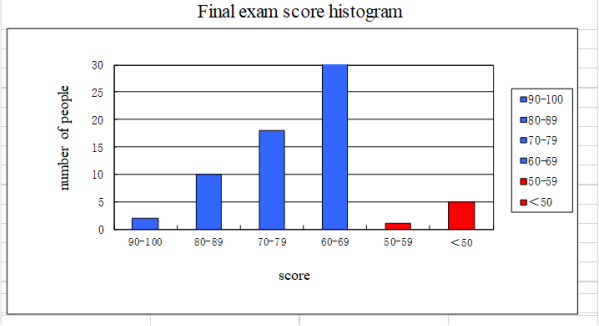


Figure 8. Analysis of final exam results in 2022-2023(2)

From the results, we can see that the students' exam scores have improved significantly, the average score has increased from 67 to 72, and the pass rate has increased from 79% to 93%. At the same time, the number of students with grades between 80 and 100 increased by 35%, which indicates that students' mastery of knowledge has improved a lot. At the same time, the scores of the unqualified students have also improved significantly compared with before, and the number of students whose scores below 50 has decreased significantly.

5. Conclusion

Through the research and practice introduced in this paper, the reform of project-based teaching method based on maintenance work order under the mode of ' heterogeneous class ' is explored. We can have the conclusion that improve the English level of students majoring in mechanical and electrical engineering, especially the cultivation of English level of mechanical and electrical engineering, encourage students to learn professional English knowledge suitable for their own and industry development trend, and provide professional, high-quality and all-round talents for social development.

The innovations of this method are as follows:

(1) To explore the reform of project-based teaching method based on maintenance work order under the mode of ' heterogeneous class '. Taking the maintenance task as the modular teaching project, the situational teaching based on the maintenance work order is carried out in the form of group task discussion. To change the original passive teaching based on textbook learning.

(2) Explore the blended teaching method based on flipped classroom. The introduction of network terminal evaluation, vocabulary card practice, online learning platform based on learning through the process of evaluation system and other methods to improve the classroom ecology.

(3) Deeply explore the ideological and political elements of electromechanical technical English courses, explore the elements of craftsman spirit and scientific innovation, cultivate students' patriotic feelings, improve students' professional quality, explore the elements of international vision, and apply them to teaching practice.

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