

Exploration of Vocational Education Model for Aviation Maintenance Talents

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Abstract: Aviation maintenance is a necessary guarantee for aircraft to complete safe flight tasks, and it is an indispensable work content in the aviation field. It is very important to carry out vocational education for aviation maintenance personnel in order to adapt to the development needs of the aviation industry, benchmark the international aviation maintenance level, and improve the domestic aviation maintenance level. Focusing on the current situation of aviation maintenance in China, we aim to carry out vocational education in aviation maintenance and explore vocational education models and support systems that meet practical needs. We have sorted out the promotion of vocational education for aviation maintenance talents from multiple dimensions and provided corresponding constructive suggestions.

Keywords: Aviation maintenance, Vocational education, System design, MOOC

1. Introduction

The report of the 19th National Congress of the Communist Party of China clearly states that priority should be given to the development of education, the vocational education and training system should be improved, and the integration of industry and education, as well as school enterprise cooperation, should be deepened. On January 24, 2019, the State Council issued the Implementation Plan for National Vocational Education Reform. Vocational education is an important component of the national education system, and industry oriented vocational education is a "supplement" to enhance job skills and abilities, as well as a strong guarantee for lifelong vocational learning. With the continuous advancement and development of technology, new requirements have been put forward for talent cultivation in various industries, especially in the field of aviation maintenance. There are many intelligent advanced equipment, new technologies and technologies are widely used, and safety requirements are prominent. To meet the needs of talent cultivation in the aviation maintenance field, we should accelerate the exploration of higher vocational education models for aviation maintenance, and strive to cultivate industry elites and high-quality maintenance teams in aviation maintenance, in order to improve the maintenance level and capabilities of the entire industry[1-3].

2. Current situation of aviation maintenance vocational education

2.1. Composition and characteristics of aviation maintenance personnel

The input of aviation maintenance personnel mainly includes Double First Class universities and established aviation and military industry colleges, as well as aviation vocational and technical colleges in various regions. The former mainly focuses on general theories in the professional field during their school years, and rarely offers maintenance courses. Only a small number of universities such as Shenyang University of Aeronautics and Astronautics provide "Aircraft Mechanical and Electrical Maintenance Auxiliary Majors" and "147 Training", which to some extent increases the gap between students and their careers; The latter focuses more on skill education for oneself and the industry, but is relatively weak in terms of theoretical level, which restricts further career development. In addition, some civil aviation and general aviation have also recruited outstanding technicians who have retired from the Marine and Air Force Machinery Brigade; Military aircraft maintenance personnel mainly come from

local colleges and soldiers trained by the military. In daily work, maintenance personnel are mainly divided into elderly and new personnel. Old maintenance personnel are familiar with maintenance business and skilled, but often have preconceived notions about the existence of different degrees of non-standard use and operation of new equipment. In addition to insufficient business ability and technical level, new maintenance personnel also have a strong dependence on psychology, a tendency towards theory, and a rejection of management models and operational norms. However, their advantages are willingness to learn, high enthusiasm, and strong innovation consciousness[4-7].

2.2. Tasks for aviation maintenance positions

Aviation maintenance can be divided into four categories based on maintenance tasks: maintenance management, electromechanical maintenance, electrical maintenance, and accessory maintenance. Of course, it can also be further subdivided according to route maintenance and scheduled inspection maintenance. Each task corresponds to a different position, and the job competency also varies. Maintenance management involves the entire aviation business, establishing efficient and reliable aviation maintenance plans and daily management models; Mechanical and electrical maintenance should be familiar with the structure and working principle of the aircraft and its main accessories, to ensure its ability to reliably and safely complete flight tasks; Understand the basic knowledge of aircraft electrical maintenance and repair, and have the ability to inspect and maintain power systems, electric oil pumps, lighting systems, etc; Accessory maintenance requires maintenance personnel to have the ability to analyze the causes of faults, troubleshoot them, and complete repairs. Route maintenance includes pre flight, short stop, and post flight troubleshooting of aircraft, engines, and other malfunctions on the route according to work orders and corresponding manuals; Regular inspection and maintenance is a routine inspection and repair carried out when an aircraft or component reaches a certain usage limit based on airworthiness data, but does not include refurbishment. In addition, specific maintenance may vary due to factors such as model, major repairs, and minor repairs [8].

2.3. Problems Faced by Aviation Maintenance

The difficulties and challenges faced by aviation maintenance are both internal and external factors of the maintenance team, but they are intertwined in practical work. Firstly, the professional abilities and levels of maintenance personnel vary, and there is a shortage of high-quality and high-level maintenance talents [9]. The space for job development is limited, and there is a lack of passion for the position, resulting in insufficient emphasis on vocational education and difficulty in carrying out vocational education. Secondly, the progress of testing and maintenance equipment is not high enough, and the level of intelligence is also insufficient. The discourse power in the maintenance field is still dominated by the West. With the localization of military fighter jets and the mass production of domestically produced large aircraft, China still lacks the corresponding level of aviation maintenance, the ability to formulate maintenance standards, and the ability to develop testing and maintenance equipment. Therefore, it is urgent to fill the gaps in aviation maintenance capabilities. Finally, it is difficult for advanced maintenance technologies and methods from abroad to be introduced to China due to limitations such as technological protection and technological monopoly, as well as the relatively weak independent innovation ability in China's aviation maintenance field, which further leads to difficulties in China's aviation maintenance transformation from traditional maintenance methods to intelligent modern maintenance. In response to the problems faced by aviation maintenance, solutions should be found from two directions: internal and external factors. Considering that the theme of the article is aviation maintenance vocational education, the focus is on exploring the model and system architecture of aviation maintenance vocational education.

3. Aviation Maintenance Vocational Education Model and System Architecture

3.1. Vocational education of "Internet plus"

Vocational education has existed in China's education system for a long time, limited by various factors such as reality, and has long been well-known to the public as vocational education. With the advancement of technology and the acceleration of industry transformation and upgrading, vocational education has attracted high attention from the Party and the government. Especially on the basis of the progress of informatization and intelligence and the improvement of the national economy, the reconstruction of vocational education of "Internet plus+" and "5G+Internet plus" has been proposed.

The use of MOOC platform for vocational education has become a major support for vocational education in multiple industry departments and fields, and has been widely recognized. The courses obtained from searching "Aviation Maintenance" and "Aircraft Maintenance" on the MOOC platform of Chinese universities are shown in Table 1. As shown in Table 1, the course categories are relatively diverse, but the number of courses and vocational courses are relatively few. At the same time, the courses are mostly vocational education courses, rather than true vocational education courses, which makes it difficult for maintenance personnel to carry out targeted learning, accurately locate the required knowledge, and save learning time to the greatest extent possible. Therefore, MOOC platform education is a way of knowledge vocational education, which is not equal to "Internet plus" vocational education, nor to vocational education.

Table 1: MOOC Retrieval Course Results.

| Course categories | Aviation maintenance | | Aircraft maintenance | |
|--------------------------|----------------------|-----------------------------|----------------------|-----------------------------|
| | Number of courses | Number of occupational tags | Number of courses | Number of occupational tags |
| Introduction to Aviation | six | | one | |
| Electrical maintenance | one | one | one | one |
| Mechanical maintenance | one | one | one | one |
| Aviation English | two | two | one | one |
| engine | four | | | |
| Aircraft maintenance | one | one | three | three |
| Aircraft materials | one | | | |
| Aircraft inspection | one | one | | |
| other | twenty-four | | twenty-one | |
| total | forty-one | six | twenty-eight | six |

3.2. Exploration of Innovative Aviation Maintenance Vocational Education Model

Vocational education is different from academic education, emphasizing the teaching model of integrating science and technology and connecting schools and enterprises, and implementing the cultivation of vocational education identity and sense of achievement in vocational education. For military aircraft maintenance units, the focus is usually on maintenance with research as a supplement. While cultivating the skill level of maintenance personnel, attention should also be paid to the cultivation of innovative abilities. The vocational education for aviation maintenance should be a combination of multiple methods, with a focus on meeting the specific needs of the population, forming a four in one collaborative model of maintenance bases, repair shops, manufacturing factories, and universities are shown in Figure 1, to achieve the theoretical and skill level improvement of corresponding needs.

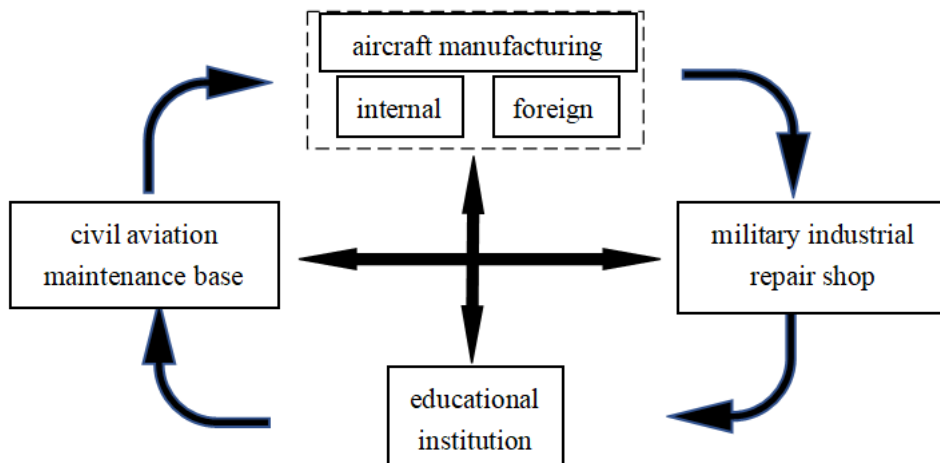


Figure 1: Four in One Collaboration Mode Diagram.

3.3. System Architecture of Aviation Maintenance Vocational Education

Aviation maintenance is directly oriented towards practical work. To construct a vocational education system, it is necessary to clarify the composition and characteristics of the target audience, identify commonalities, and differentiate between them. Corresponding course content should be set according to specific tasks and work needs, and multiple educational models should be adopted, especially to implement specific tasks in practice. The personnel composition, maintenance task course categories, and educational forms have already been introduced and covered in the previous text. Here, we focus on introducing some specific tasks. The development of vocational education depends on the educational form adopted. Choosing the MOOC platform as an educational tool makes the quality control of MOOC curriculum construction very important. The specific structure and framework design of the curriculum also need to be responsible for the characteristics of vocational education learners; Especially for vocational education for each type of population or specific content, targeted outlines, textbooks, or breaks should be provided; It is possible to establish a practical training base jointly built by multiple parties and units as a training ground for experience exchange and skill training; Adopting online and offline expert lectures, establishing industry expert groups and efficient expert Q&A communication mechanisms; For enterprises and job teams, it is necessary to implement the national new master apprentice system. During daily work breaks, enterprises should organize skill competitions at various levels. The aviation industry should hold industry wide maintenance and repair competitions to enhance the sense of honor and social identity of maintenance personnel, discover great country craftsmen and technical experts, and let them step onto the podium to pass on practical experience to their peers[10].

4. Important aspects of aviation maintenance vocational education

4.1. Highlighting the construction of aviation maintenance demand end

Aviation maintenance focuses on troubleshooting ability and reliability testing level, and vocational education should closely focus on highlighting the generation and improvement of combat effectiveness in maintenance. In the design of vocational education courses, new maintenance methods and equipment usage courses should be introduced, especially in the areas where there are obvious shortcomings in aviation maintenance in China. Strengthening problem-solving oriented vocational education should not make it a machine for imparting knowledge, but rather organically unify demand with identifying and filling gaps. Based on the different theoretical and technical requirements of different maintenance personnel and departments, as well as the different equipment usage needs, provide a "demand menu" for "side dishes" and "cooking", then "serving", customers "trying" ratings, and finally "promoting dishes". In the construction of the demand side of aviation maintenance vocational education, it is necessary to develop a clear education path, fully prepare the "raw materials" and "ability to prepare dishes" that can be used to place orders for customers, as well as the technology of "making dishes", and have the ambition of promotion. The construction of the demand side is crucial for aviation maintenance, as it closely aligns with the frontline work and addresses the work needs of maintenance personnel through targeted vocational education.

4.2. Benchmarking Internationalized High Level Aviation Maintenance

Compared to Western countries, China's aviation industry started relatively late, and with decades of development in the domestic aviation industry, it has also accumulated certain aviation maintenance experience. However, there is still a certain gap in overall level compared to the West. Western aviation enterprises are far more advanced than Chinese aviation enterprises in terms of progressiveness of equipment used for maintenance, systematization of maintenance experience, emergency mechanism of maintenance, curriculum setting of maintenance, and investment in maintenance research. Exploring how to narrow the gap with the West and achieve international standard maintenance levels, on the one hand, is to attach importance to the introduction of advanced talents and carry out high-quality vocational education curriculum introduction projects; On the other hand, it is necessary to send outstanding potential stock maintenance personnel abroad for learning and exchange, and bring their technology back to the domestic aviation maintenance industry. Of course, we also need to pay attention to the differences in management and other aspects between China and the West in the aviation field. Therefore, the learning of aviation maintenance in the West should be clearly defined at the technical level and within a certain range of processing mechanisms. Our goal in benchmarking international high-level aviation maintenance is to strive to establish a maintenance industry standard with China's discourse system and

authority, as well as a high-quality aviation maintenance vocational education model.

4.3. Grasp the advantages of military civilian integration in aviation maintenance

There are two main groups in China's aviation maintenance field: civilian maintenance and military maintenance. For a long time, China's civilian maintenance targets have mainly been passenger planes purchased from the West, and the maintenance standards must be strictly carried out in accordance with the maintenance manual. With the opening of the general aviation field, multiple domestic aviation manufacturing units have started producing general aircraft and have also formulated corresponding maintenance manuals, but have not established corresponding maintenance systems. The maintenance of military aircraft in our country has been accompanied by the localization of our country's military aircraft, from the coexistence of early Soviet style introduction and localization to the transformation and upgrading towards comprehensive localization. The field of military aircraft maintenance has always been moving forward with the localization of our country's military aircraft, with a high degree of repair and research connection. In vigorously promoting the development of military civilian integration in the country, it is necessary to attach great importance to the high-quality experience exchange of civil aircraft maintenance and military aircraft maintenance, especially the civilian use of advanced military aircraft maintenance equipment and the military use improvement and upgrading of new Western equipment introduced for civil aircraft maintenance. Only by seizing the advantages of military civilian integration, utilizing the opportunity of domestic large aircraft research and development, integrating advanced resources in the domestic maintenance industry, establishing supporting guidelines for the domestic large aircraft maintenance industry, and filling a gap in China's aviation maintenance industry, can we enhance the international market competitiveness and international discourse power of domestic large aircraft research and development and maintenance.

5. Conclusions

Carrying out vocational education in aviation maintenance is a positive response to the country's promotion of vocational education in the industry, and it is also an urgent need in the aviation maintenance field. Aviation maintenance has its own industry characteristics, and corresponding vocational education should be closely aligned with problem orientation and actual situations, exploring its unique vocational education models and goals. China has accumulated a lot of experience and resources in academic and vocational education, and the basic conditions for informatization and networking have been improved. The overall strength of aviation enterprises has also been equipped, which is suitable for adopting various teaching methods for vocational education of aviation maintenance talents to achieve efficient transformation of learning and training results.

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