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Research on the Gap in Teaching Proficiency in the Aerospace Discipline between Western and Chinese University Professors, and Improvement Methods

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Abstract: This study aims to identify the teaching gap between Chinese university professors and those from developed countries in Europe and north America in the aerospace discipline, and explore methods to bridge these gaps. Aerospace discipline is a highly specialized and cutting-edge field where the teaching proficiency of professors directly impacts students' learning outcomes and professional competence. The research findings reveal that professors from developed countries generally possess deeper expertise and practical experience in this field, enabling them to deliver higher-quality instruction. In contrast, Chinese university professors exhibit relatively lower teaching proficiency in the same domain. This has significant implications for aerospace education and research in China, as the aerospace discipline holds strategic importance in national security, defense construction, and economic development. Therefore, enhancing the teaching proficiency of Chinese university professors in this discipline is crucial for fostering exceptional talent, driving research innovation, and boosting national capabilities. This study proposes a series of improvement methods, including fostering students' creativity and critical thinking, enhancing teaching methods through innovation and improvement, strengthening collaboration and exchange with industry. Through these methods, the teaching proficiency of Chinese university professors in the aerospace discipline can be enhanced, providing a conducive teaching environment and faculty resources for cultivating high-quality talent and promoting innovation in the field. This will have a positive impact on the development of China's aerospace industry and contribute to enhancing the country's competitiveness and capabilities in this domain.

1. Introduction

With the increasing popularity of the aerospace discipline in China in recent years, the teaching gap between Chinese university teachers and those from developed countries in Europe and north America has become a significant constraint on aerospace education and research in China. Firstly, the aerospace discipline is a highly specialized and cutting-edge field where the teaching

proficiency of professors directly affects students' learning outcomes and professional competence. Professors from developed countries typically possess deeper expertise and practical experience, enabling them to provide higher-quality instruction. Secondly, the aerospace discipline holds strategic importance in national security, defense construction, and economic development. The advancement of aerospace technology requires the cultivation of high-quality talent and research innovation, where the teaching proficiency of professors directly determines students' academic abilities and innovative potential [1-3]. Enhancing the teaching proficiency of Chinese university professors in the aerospace discipline is of great significance for fostering outstanding aerospace talent, driving research innovation, and elevating the nation's aerospace capabilities [4-5]. To improve the teaching quality for their own students, lecturers in Chinese universities can take the following measures by drawing lessons from the teaching experiences of top aerospace departments in Western countries [6-7].

2. Emphasizing the cultivation of students' creativity and critical thinking

In top aerospace departments at universities in Europe and North America, professors often encourage students to engage in independent research and exploration, focusing on fostering their innovative and problem-solving abilities[8-9]. Therefore, lecturers in China's aerospace discipline can draw from this experience by designing open-ended learning tasks and projects to stimulate students' creativity and critical thinking. Organizing group discussions and team projects can encourage collaboration among students to solve complex problems, fostering their teamwork and communication skills. Additionally, providing practical opportunities and laboratory experiences allows students to actively participate in aerospace projects and experiments, enhancing their practical skills and problem-solving abilities. Here are some specific practices and experiences from universities in Europe and America:

2.1 Project-based learning

Many aerospace departments in universities in Europe and America adopt project-based learning, allowing students to engage in real engineering projects. For example, students at the Massachusetts Institute of Technology (MIT) can participate in designing and manufacturing a small aircraft, being involved in the entire process from design to testing, fostering their innovation capabilities and practical skills. In contrast, there are fewer project-based learning opportunities in Chinese universities, where students are more often passively receiving knowledge in their education. Chinese universities can actively collaborate with aerospace companies or research institutions to provide opportunities for practical projects, allowing students to actively participate in engineering practices and cultivate their creativity and problem-solving abilities.

2.2 Project-based learning encourages independent thinking

Aerospace departments in universities in Europe and America emphasize the cultivation of students' critical thinking, encouraging them to question and challenge existing theories and perspectives. For example, professors in the aerospace discipline at Stanford University encourage students to analyze and evaluate current aerospace technologies and policies, and to propose their own insights and solutions. In contrast, Chinese university professors generally focus more on imparting knowledge and may lack the cultivation of students' independent thinking abilities. Chinese university professors should encourage students to actively participate in classroom discussions, express their own viewpoints, and engage in debates. Designing open-ended questions can guide students to think critically and propose solutions, fostering their critical thinking abilities.

2.3 Interdisciplinary integration

Aerospace departments in universities in Europe and America often encourage students to engage in interdisciplinary learning and research. For example, the aerospace discipline at the University of California, Berkeley collaborates closely with computer science, materials science, and other related disciplines, offering interdisciplinary courses and research projects. This interdisciplinary integration helps cultivate students' comprehensive abilities and innovative thinking. In contrast, in Chinese universities, the aerospace discipline is relatively independent, with limited interdisciplinary collaborations. Chinese universities can encourage interdisciplinary cooperation between the aerospace discipline and related fields, offering interdisciplinary courses and projects that allow students to transcend disciplinary boundaries and broaden their knowledge and perspectives.

In conclusion, to enhance the cultivation of students' creativity and critical thinking in the aerospace discipline at Chinese universities, teachers can draw inspiration from the advanced experiences of universities in Europe and America. Encouraging project-based learning, fostering independent thinking abilities, and promoting interdisciplinary integration are key aspects. By collaborating with companies to provide practical opportunities, guiding students to participate in classroom discussions and propose solutions to foster critical thinking, and offering interdisciplinary courses and collaborative research to promote disciplinary integration, the deficiencies in cultivating students' creativity and critical thinking at domestic universities can be effectively addressed. Additionally, teachers should focus on personalized guidance and care, establish good teacher-student relationships, understand students' learning needs and interests, and provide appropriate support and guidance. By comprehensively implementing these improvement measures, the quality of cultivating students' creativity and critical thinking in the aerospace discipline at Chinese universities can be gradually enhanced.

3. Emphasizing improvement and innovation in teaching methods

In top aerospace departments at universities in Europe and America, instructors often employ diverse teaching methods such as heuristic teaching, case studies, and simulations. Chinese lecturers can draw inspiration from these methods and utilize multimedia, experimental demonstrations, simulation software, and other approaches to make abstract theoretical knowledge more tangible and understandable for students[10-11]. Introducing real-life cases and problems allows students to apply the knowledge they have learned to practical scenarios, enhancing their motivation to learn. Additionally, emphasizing student feedback and evaluation is crucial. Providing timely feedback on students' learning outcomes and progress encourages them to continue their efforts and improve. There are numerous advanced examples of improvement and innovation in teaching methods in European and American universities. Here are some specific examples:

3.1 Motivating student engagement

Some universities in Europe and America employ interactive teaching methods to encourage active student participation. For instance, in a psychology course at Harvard University, instructors organize group discussions and role-playing activities to stimulate student thinking and interaction. In contrast, Chinese universities generally rely on traditional lecture-style teaching, where students passively receive knowledge and lack opportunities for active engagement. Chinese university teachers can introduce interactive teaching methods, such as group discussions, case analyses, and role-playing, to actively stimulate student participation and thinking, thereby enhancing teaching effectiveness.

3.2 Utilizing technological means

Many universities in Europe and America make full use of technological tools in teaching, such as online learning platforms and educational software. For example, a computer science course at Stanford University provides an online programming platform where students can engage in programming practice and submit assignments at any time. In contrast, Chinese universities have made relatively less use of technological means in their teaching and still rely on traditional printed textbooks and face-to-face lectures. Chinese universities should increase their efforts in applying and promoting educational technology, providing online learning platforms and educational software to enrich teaching resources and enhance students' learning experience and outcomes.

3.3 Interactive teaching

A course on artificial intelligence at Stanford University utilizes an online interactive teaching platform. Students can engage in real-time interactions on the online platform, asking questions, answering queries, and participating in discussions with other students. In contrast, Chinese universities commonly rely on traditional lecture-style teaching, resulting in lower student engagement. Chinese universities can encourage instructors to introduce online interactive teaching platforms, providing opportunities for student interaction, such as online discussion forums and instant Q&A platforms.

3.4 Practical-oriented teaching

A bioengineering course at the Massachusetts Institute of Technology (MIT) emphasizes practical-oriented teaching. Students actively participate in experiments, projects, and case analyses in the classroom, applying theoretical knowledge to solve real-world problems. In contrast, teaching at Chinese universities often focuses on imparting theoretical knowledge with limited practical components. Chinese universities can increase the emphasis on practical teaching by offering laboratory courses, organizing student participation in projects, and promoting engagement in social practices.

3.5 Diversified assessment methods

An English writing course at the University of Cambridge utilizes diversified assessment methods. In addition to traditional written exams, students are required to complete writing assignments, deliver oral presentations, and participate in group discussions. In contrast, assessment methods in Chinese universities often heavily rely on written exams, neglecting students' oral expression and collaborative abilities. Chinese universities can explore diversified assessment methods, including writing assignments, oral presentations, group discussions, and more, to comprehensively assess students' abilities and performance.

3.6 Innovative teaching tools

An economics course at Harvard University incorporates the use of virtual reality technology. Students can explore businesses and markets through virtual reality devices, gaining a deeper understanding of economic mechanisms. In contrast, Chinese universities have made limited use of innovative teaching tools in their instruction. Chinese universities can encourage instructors to explore the use of new technologies and teaching tools, such as virtual reality and online simulations, to enhance students' learning experience and improve teaching effectiveness.

There are numerous advanced practices and experiences in teaching method improvement and innovation in universities in Europe and America. In comparison, Chinese university instructors have some shortcomings in various aspects, such as interactive teaching, practical-oriented instruction, diversified assessment methods, and innovative teaching tools. To address these issues and improve the situation in Chinese universities, it is recommended that instructors introduce interactive teaching platforms, increase practical teaching components, adopt diversified assessment methods, and leverage innovative teaching tools to enhance teaching quality and improve student learning outcomes.

4. Strengthening cooperation and communication with the industry

Top aerospace disciplines in universities in Europe and America often maintain close ties with the aerospace industry, engaging in collaborative research and projects, and providing students with practical opportunities and career development support[12-13]. Chinese instructors can actively collaborate with relevant companies and research institutions, organize student participation in real projects and internships, allowing students to be exposed to the latest technologies and industry trends. Additionally, inviting industry experts to give lectures and engage in discussions on campus can help students understand industry demands and cutting-edge knowledge, broaden their perspectives, and explore career development paths. Universities in Europe and America have numerous advanced examples of strengthening cooperation and communication with the industry. Here are some specific examples:

4.1 Industry-academia collaboration projects

The University of Cambridge in the UK has collaborated with the London financial district on a financial technology innovation project. This project invites professionals from the fintech industry to serve as mentors, guiding students in the development of actual fintech projects and providing practical experience. In contrast, there are relatively fewer cooperation projects between Chinese universities and the industry, resulting in limited opportunities for students to engage with real-world projects. Chinese universities can actively collaborate with the industry, initiate industry-academia collaboration projects, and invite industry professionals to participate in teaching, offering practical opportunities and guidance to students.

4.2 Internship and employment opportunities

Stanford University in the United States has established close partnerships with numerous technology companies, providing students with internship and employment opportunities. These collaborations include projects with companies such as Google and Apple, giving students the chance to apply their learned knowledge in real work environments. In contrast, Chinese universities have fewer channels for cooperation with the industry, leading to significant challenges for students in finding internships and employment. Chinese universities can actively establish partnerships with companies in various fields, broaden students' internship and employment channels, and provide practical work experience.

4.3 Entrepreneurship support and incubators

UC Berkeley in the United States has established an entrepreneurship incubator that provides students with entrepreneurship support and resources. The incubator offers office space, mentorship, funding support, and more, assisting students in transforming their ideas into entrepreneurial

projects. In contrast, the entrepreneurship support system in Chinese universities is relatively weak, and students face significant challenges in starting their own businesses. Chinese universities can establish entrepreneurship incubators and support organizations to provide students with entrepreneurship resources and guidance, helping them realize their entrepreneurial dreams.

4.4 Research collaboration and technology transfer

The Technical University of Berlin in Germany has collaborated with companies on numerous research projects and actively promoted the transfer and commercialization of technology outcomes. The university has established close partnerships with companies, fostering technological innovation and industrial development. In contrast, the cooperation mechanisms between Chinese universities in research collaboration and technology transfer are relatively weak, resulting in a lower level of commercialization for technological achievements. Chinese universities can strengthen their research collaboration with companies, establish technology transfer institutions, and promote the commercialization of technological outcomes and industrial development.

In conclusion, universities in Europe and America have valuable experiences in strengthening cooperation and communication with the industry. To address the shortcomings in this regard in Chinese universities, it is recommended that instructors actively establish industry-academia collaboration projects, broaden students' internship and employment channels, establish entrepreneurship incubators and support organizations, strengthen research collaboration, and enhance technology transfer. Through close collaboration with the industry, Chinese universities can enhance students' practical skills, innovative capabilities, and competitiveness in the job market, promoting industrial development and societal progress.

5. Conclusions

Drawing from the teaching experiences of top aerospace disciplines in universities in Europe and America, instructors in Chinese aerospace disciplines can focus on cultivating students' creativity and critical thinking, improving and innovating teaching methods, strengthening cooperation and communication with the industry. These measures will contribute to enhancing the teaching quality for students in their respective institutions and nurturing aerospace professionals with greater innovative and practical capabilities. It is important for instructors to keep their teaching philosophies updated and progressive, actively exploring teaching models and methods suitable for Chinese aerospace disciplines, continuously improving their own educational and teaching competence, and promoting the development of aerospace education.

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