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Exploring the Design and Practice of Ideological and Political Education in the Course of Tunnel Engineering under the Background of New Engineering Discipline: A Case Study of Hope College, Southwest Jiaotong University

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Abstract

Under the background of the new engineering discipline, talent cultivation requires not only intellectual education but also moral education. In response to the main issues concerning ideological and political education in the current new engineering discipline curriculum, this paper focuses on exploring the process of ideological and political construction in tunnel engineering. It highlights the necessity of curriculum-based ideological and political education and the exploration of ideological and political elements. These elements are cleverly integrated into the course design, and the effectiveness of the ideological and political practice in the curriculum is examined through an evaluation of teaching outcomes. The aim is to improve the educational effectiveness of the tunnel engineering construction course and provide valuable insights and references for the ideological and political construction in other engineering disciplines.

Keywords

New Engineering Discipline, Tunnel Engineering Course, Ideological and Political Education

1. Introduction

The development of the new engineering discipline is a response to the new round of technological revolution and industrial transformation. It emerged under the backdrop of the new economy characterized by new technologies, industries, business models, and patterns. The construction of the

new engineering discipline is guided by the principles of moral education and talent cultivation, aiming to address changes and shape the future. It emphasizes both inheritance and innovation, and strives to cultivate diverse and innovative engineering talents. Under the context of the new engineering discipline, talent cultivation not only focuses on acquiring professional knowledge and skills but also requires students to possess strong engineering practice and innovation and entrepreneurship abilities. This has become an important indicator for measuring a country's competitiveness and international status.

Course ideology and politics is a significant leap in the guidance of curriculum teaching in universities, as well as a major transformation in the teaching methods and content of disciplines. It integrates ideological education into professional courses, giving ideological education a vibrant vitality, while enriching the intrinsic connotation of professional courses and expanding their educational and teaching functions. While mastering the basic theoretical knowledge of the curriculum, it aims to cultivate college students' love and identification with engineering industries such as roads, bridges, and tunnels, stimulate students' sense of pride in engaging in the construction industry, and aspire to become outstanding civil engineering professionals with national consciousness, legal awareness, environmental awareness, and a willingness to take on responsibilities and dedicate themselves to their professions. The purpose of exploring course ideology and politics in this article is to delve into the key points of course ideology and skillfully integrate them into curriculum design, and to examine the effectiveness of course ideology and politics through the inspection of teaching outcomes.

2. The Reflection of Ideological and Political Elements in the Curriculum

2.1 National Consciousness

When teaching "Tunnel Boring Method Construction", we first introduce the development process of tunnel boring machines (TBMs), from the initial reliance on imports to independent research and development, and finally to exporting to many countries. This progression reflects the rapid development of China's infrastructure industry. By learning professional knowledge, students can also feel a sense of pride and honor in the rapid development of our country, as well as ignite a sense of responsibility to contribute to the future development of our country's infrastructure industry.

The rapid development of a country is inseparable from the construction of high-quality and high-level foundation projects. As one of the fundamental infrastructure projects, tunnel engineering is not only about completing individual projects but also an essential driving force behind the rapid development of our country. The continuous iteration and updating of tunnel construction techniques, machinery, and methods signify the constant development and improvement of the tunnel engineering industry from various aspects. At the same time, it also drives the development of other industries and can significantly enhance the development of a region. Therefore, tunnel construction is not just a project; it holds significant social value. As future professionals in the engineering industry, this belief is essential for us students, as it lays a solid foundation for better learning of tunnel engineering knowledge and

engaging in tunnel construction work.

2.2 Social Responsibility

When introducing the tunnel engineering course, we include an introduction video of the Gaolongla Tunnel construction materials and construction background. The Gaolongla Tunnel has extremely complex terrain and geology, earning it the nickname "Encyclopedia of Tunnel Geological Hazards." The Armed Police Traffic Troops mobilized nearly 100 sets of the most advanced domestic drilling and excavation equipment, employing 12 construction techniques such as pipe shed grouting, concrete anti-freezing and thawing, construction on high-altitude faults, and deep infusion in seismic areas. They successfully overcame 11 major faults and glacial debris flow accumulations. The construction of the Gaolongla Tunnel brings hope for Xizang Motuo County, the only county in China without a road, to bid farewell to its history of being inaccessible by road. The historical separation of the Motuo people, who have been blocked by vast snow-capped mountains for generations, finally comes to an end. The officers and soldiers overcame numerous difficulties to create miracles in tunnel construction, all for the happiness of the local people. We let the students collect and organize Gaolongla Tunnel construction materials and construction background videos in groups, and then have representatives from each group present their work. These materials serve as living textbooks, allowing students to learn about engineering background information, understand the construction methods and techniques used in the process, experience the joy of overcoming various challenges, and deeply touch their hearts.

2.3 Spirit of Craftsman

When discussing the commonly used methods in tunnel construction, we introduce the construction case of the Hong Kong-Zhuhai-Macao Bridge. The bridge holds the record for the world's longest overall span, the heaviest immersed tube, and the longest immersed tube tunnel across the sea. Although China has a history of constructing cross-river tunnels, prior to the Hong Kong-Zhuhai-Macao Bridge, the total length of immersed tube tunnels in China was less than 4 kilometers. Moreover, this was the first time that China constructed an immersed tube tunnel in a marine environment, without any previous experience to draw upon. Everything had to start from scratch.

According to the design plan, the construction team needed to excavate a 5,664-meter-long underwater tunnel trench in the waters of the Lingdingyang Sea, with a maximum excavation depth of 48.5 meters and an error tolerance of no more than 0.5 meters. However, the geotechnical conditions at the site of the Hong Kong-Zhuhai-Macao Bridge consisted of thick soft soil layers with a thickness ranging from 30 to 50 meters. This made it extremely challenging to control the settlement of the immersed tube foundation. If there were problems with the foundation, it would lead to more serious issues such as water leakage in the immersed tube tunnel. Therefore, after numerous comparisons of construction methods, theoretical calculations, and experimental verifications, the engineers of the immersed tube tunnel designed a new foundation scheme that combined composite ground improvement with a combination of base courses. By utilizing a portion of the composite base course, the settlement of the

tunnel could be controlled within 5 centimeters, which was several times less than the planned settlement standard of 20 centimeters.

Faced with this highly challenging project, the transportation construction team in China did not fear but instead confronted the challenges head-on, solving difficulties and completing the construction of the underwater tunnel with high quality and precision. The spirit of craftsmanship was fully demonstrated. Through studying this vivid case, students not only understand the applicability of the immersed tube method and become familiar with the common difficulties encountered in its construction process but also learn the construction team's unwavering spirit and feel proud of their accomplishment in building such a world-renowned project.

2.4 Normative Consciousness

According to relevant statistics, one-third of tunnel construction accidents each year are caused by a failure to adhere to relevant regulations during the construction process. Establishing a sense of compliance with regulations is crucial for ensuring engineering quality in construction projects. Proper construction must strictly follow the relevant specifications and standards for tunnel construction. From project initiation to survey and design, from survey and design to construction, and finally to the operational stage, different types of tunnels and different stages of construction work have corresponding specifications and standards for tunnel construction.

By studying relevant case studies of construction accidents, students can understand the serious consequences of non-compliant construction and the potential losses it can bring to society and families. This helps students develop a strong awareness of the importance of adhering to regulations from within. By presenting the relevant content of existing standards to students, they can learn about the seriousness of compliance and realize the necessity of approaching construction with a serious and earnest attitude.

3. Curriculum Ideological and Political Content Design

3.1 Based on the Characteristics of the Course, the Content of Ideological and Political Teaching Is Designed

Based on the characteristics of tunnel engineering courses, integrating ideological and political education content into each chapter is a meaningful approach to organically combine course teaching with ideological and political education.

For example, in the introduction section, we can start with the Badaling Railway Tunnel, which was the first mountain-crossing railway tunnel built independently by China. This example helps students understand the importance of a country's independent and self-reliant development in the field of science and technology. It also aims to stimulate students' sense of patriotism and their love for their country.

3.2 Based on the Characteristics of the Industry, We Organize Ideological and Political Teaching Activities

By deeply analyzing the characteristics of the engineering industry, ideological and political education activities can be organized in various forms:

Offline teaching: Bring real-life engineering examples into the classroom and utilize multimedia and situational teaching methods to guide students in self-learning. Continuously improving the students' learning experience enhances their sense of professional identity, stimulates their thirst for knowledge, instills a sense of pride in being an engineer, and cultivates their spirit of innovation.

Online teaching: Make full use of information technology and online learning platforms to expose students to the cutting-edge knowledge in the field of engineering. Help students perceive the convenience brought by technological advancements to social progress. At the same time, guide students to adopt a forward-looking perspective, keep up with the times, and strive to become engineers of the new era who possess a sense of patriotism and are willing to shoulder the responsibilities of the times.

Integration of theory and practice: Organize student internships and visits to tunnel construction and operation sites to provide students with a more intuitive understanding of the engineering industry. This allows them to gain a deeper insight into the current development status of the tunnel engineering industry and motivates them to study with enthusiasm for the rise of China.

Combination of positive and negative case studies: By introducing the current development status and world rankings of tunnel construction in China, as well as major national projects like the Hong Kong-Zhuhai-Macao Bridge, students' patriotism is enhanced, and a sense of professional honor is established. Simultaneously, through the analysis of typical accident cases such as the significant water seepage incident in the Zhuhai Shijing Mountain Tunnel, students are educated about the importance of having a high sense of social responsibility, respecting engineering construction and life, strictly adhering to professional ethical standards, and establishing correct life and value perspectives. Through the reflection and comparison of positive and negative case studies, students' ability to discern and their sense of social responsibility can be improved..

3.3 Student-Oriented, Reasonable Arrangement of Class Hours

Following the students' cognitive patterns, a progressive approach can be adopted by combining "offline teaching", "online resource integration", and "case-based teaching" to gradually enhance students' ideological and political awareness. The schedule should incorporate the organic integration of imparting professional knowledge and ideological and political education. During the teaching process, conscious efforts should be made to incorporate ideological and political elements to make the classroom more engaging and interesting.

4. Research on Teaching Practice Path

4.1 Investigation of Teaching Effect

Based on practical experience, our research team conducted a survey and study on the exploration of ideological and political elements in the compulsory course "Tunnel Engineering" and the implementation of ideological and political education in the curriculum. The survey results indicate that the implementation of ideological and political education has greatly improved students' enthusiasm, initiative, and enjoyment in learning. Class attendance rates have also significantly increased, leading to desirable teaching outcomes.

The majority of students have given positive evaluations regarding the introduction of the concept of "curriculum-based ideological and political education" in professional course teaching. The ideological and political objectives of the course have been largely achieved: cultivating students' patriotism and sense of national pride, fostering national self-confidence and professional honor; nurturing students' noble moral character and professional ethics; developing students' innovative spirit and their ability to correctly identify, analyze, and solve problems; and instilling in students the values of environmental protection and sustainable development..

4.2 Teaching Content Evaluation

Through a comparative analysis of students' classroom performance, attendance, assignments, course design, mid-term and final exam scores, as well as course surveys conducted across different cohorts, it can be observed that with the deeper integration of ideological and political content into the curriculum, students have shown significant improvement in their overall classroom performance and grades. This indicates that the implementation of ideological and political education can increase students' interest in learning, enhance their motivation to study, and promote their understanding, mastery, expansion, and deepening of course knowledge, resulting in positive teaching outcomes.

The implementation of ideological and political education has broadened students' horizons by exposing them to the cutting-edge knowledge in the field of engineering. Students have provided positive feedback, expressing a sense of fulfillment in their coursework and a feeling of pride and honor as aspiring engineers.

4.3 Introduce Real-Time Typical Cases

Through the study of the "7.15" water seepage accident case in the Shijingshan Tunnel, it educates students to have a strong sense of social responsibility, reverence for engineering construction and life, strict adherence to professional ethics, and the establishment of correct life and values. The combination of theory and practice has increased students' interest in learning course knowledge and made them realize the importance of knowledge. Even students who were not attentive in class have become more focused.

5. Conclusion

According to teaching feedback, after incorporating ideological and political education into the "Tunnel Engineering" course, teaching methods, content, and effectiveness have been highly recognized by students. It has facilitated their understanding, mastery, expansion, and deepening of course knowledge. Some liken ideological and political education to salt, while professional knowledge is compared to the dish. The right amount of salt enhances the flavor of the dish, and teachers need to carefully consider the amount and timing of incorporating ideological and political education to avoid adverse effects. Others compare ideological and political education to the soul of a person, while professional knowledge represents the body. Only when they coexist harmoniously can perfection be achieved. As professional course teachers, we should continuously improve our comprehensive qualities and professional knowledge, keep up with national policies, and strive to do our best in our work.

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