

Curriculum Ideological and Political Education Reform: A Case Study of "Elastic-Plastic Mechanics"

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Abstract: *Elastic-Plastic Mechanics* is an extremely important course in the field of oil and gas storage and transportation engineering. With the ongoing reforms in curriculum and ideological and political education in the new era, the course aims to integrate professional knowledge with ideological and political education. In recent years, the teaching team has continuously explored innovative approaches. By incorporating content related to esteemed predecessors, exemplary engineering projects, national policies, and industry trends into the curriculum, they aim to cultivate students' patriotic sentiments and academic confidence. Significant progress has been made so far. This method not only enhances the quality of the course but also provides a more comprehensive education for students. It can serve as valuable experience for the reform of other courses within the discipline.

1. Introduction

On December 7-8, 2016, General Secretary emphasized the importance of "moral education and nurturing talent" in his speech at the National Conference on Ideological and Political Work in Higher Education Institutions [1]. This idea has gained widespread political, theoretical, and emotional recognition from educators and university students [2]. In response, major universities have taken action by initiating reforms in ideological and political education across various disciplines and courses. Over the past five years, in order to enhance ideological and political work in higher education institutions in the new era and cultivate high-quality talents required for the new era, universities have gained a deeper understanding of General Secretary speech and embraced the essence of the "comprehensive cultivation of talents"[3]. The "comprehensive cultivation of talents" not only serves as the purpose of ideological and political education in higher education institutions but also provides direction, standards, and practical methods for carrying out ideological and political education work. Over the past five years, under the comprehensive leadership of the Communist Party of China, various measures have been implemented in higher education, multiple directions have been pursued, and the Party has firmly grasped the leadership of university work, making suggestions and rectifying errors. The development of the Party and the cause of the people require successive generations of Communist Party members in China to continue their struggle. The fundamental task lies in having capable successors. The cultivation of moral character and the

nurturing of talents are the contemporary issues emphasized by the Party and the state for teachers and students in higher education institutions. Therefore, it is essential for the faculty and students to jointly build a high-quality ideological and political work system in universities. On January 6, 2022, Huai Peng, the Secretary of the Party Group and Minister of the Ministry of Education, proposed the acceleration of building a "grand ideological and political theory course" framework during the inaugural meeting and working conference of the 2021-2025 Higher Education Ideological and Political Theory Course Teaching Guidance Committee[4]. General Secretary Xi Jinping's series of speeches and instructions on the construction of ideological and political theory courses have provided profound answers to a series of fundamental and directional questions concerning the development of ideological and political courses in schools in the new era. In ideological and political education, the focus should be on the core objectives of cultivating moral character and nurturing talents, thereby promoting the reform and innovation of ideological and political courses.

In recent years, petroleum colleges and universities have increasingly emphasized education in the field of safety, placing safety as the top priority and ensuring that all designs and construction activities are carried out under the premise of safety. Therefore, the oil and gas storage and transportation major pays particular attention to courses related to safety. In this context, "Elastic-Plastic Mechanics" as a course of this nature has also undergone ideological and political education reform. The course "Elastic-Plastic Mechanics" is specifically designed for graduate students in the field of oil and gas storage and transportation engineering. Its specialized theoretical knowledge goes beyond what general courses can provide. The course aims to develop students' practical abilities by explaining and deriving the knowledge of elasticity and plasticity that is involved in various production and daily life scenarios. The offering of this course holds significant importance for students majoring in oil and gas storage and transportation engineering.

2. Current Status of the Course

"Elastic-Plastic Mechanics" belongs to the field of solid mechanics. It focuses on studying the behavior of materials when subjected to external forces, temperature changes, or variations in boundary constraints, specifically analyzing the resulting stress, deformation, and load-carrying capacity. The course "Elastic-Plastic Mechanics" belongs to the field of solid mechanics. It studies the changes in stress, deformation, and load-carrying capacity of objects when subjected to external forces, temperature variations, or changes in boundary constraints. It encompasses a vast amount of mechanical knowledge and involves numerous formula derivations and calculations. For students, mastering this mechanical knowledge and learning to derive the mechanical formulas is a challenging and tedious task. Due to its highly theoretical nature, the course can be intimidating for many students. Therefore, in recent years, especially after General Secretary Xi Jinping proposed reforms in ideological and political education, the course has been undergoing reforms by exploring different methods to generate greater student interest. During the educational process, the course incorporates various well-known structures in our country. By using these buildings as examples, students are able to understand the results of mechanical analysis under different circumstances more intuitively. The course also integrates with the oil and gas industry, linking the theoretical concepts to the equipment encountered in future work. This approach helps students establish a practical connection and enhances their analytical skills in real-world applications. The course encourages students to engage in formula derivations to enhance their academic confidence. By deriving formulas, students experience a sense of fulfillment and satisfaction in their pursuit of knowledge. The course also implements reforms in assessment methods, allowing students to actively participate and achieve the true purpose of teaching, guiding, and clarifying doubts, rather than solely aiming for high scores in exams. Currently, there is no existing elasticity-plasticity

mechanics textbook that specifically caters to the needs of the oil and gas transportation industry. Drawing upon years of teaching and practical experience, a textbook specifically designed for professionals in the petroleum industry has been developed. This textbook integrates the knowledge of elasticity-plasticity mechanics with the concepts and practices of the oil and gas industry. It enables students to enhance their practical application and analytical skills, building upon a solid foundation of theoretical knowledge. The ultimate goal is to ensure that the acquired knowledge is not only useful but also applicable in real-world scenarios.

3. Challenges in Ideological and Political Education Reform

Previously, many universities did offer courses related to ideological and political education. During the postgraduate period, there were also teachers from Marxist institutes who would give lectures to students and faculty on "The Theory and Practice of Socialism with Chinese Characteristics" and "Dialectical Materialism." Engineering students would also study "Engineering Ethics," and in petroleum-related institutions, there would be courses on "Chinese Petroleum Culture." Indeed, one common issue with these courses is that they are often conducted in large-class settings. Due to being mandatory for the entire university, a large number of students from different majors are grouped together for instruction. This can lead to difficulties in maintaining students' attention during the class. For such courses, many students rely on last-minute memorization to achieve high grades, which defeats the original purpose of these courses. Clearly, this approach does not meet our needs for offering these courses, nor does it align with the requirements of the Ministry of Education in cultivating high-quality talents for the new era. Many universities have embarked on reforms, and the "smart classroom" is one of the outcomes of these reforms [5]. Numerous universities have upgraded their classrooms, transforming students' learning experiences from passive listening to active engagement and peer discussion. The emergence of this type of classroom has to some extent increased student participation [6], enhanced their focus, and transitioned from large-class teaching to small-class teaching, greatly improving the efficiency of knowledge acquisition and the overall teaching quality. Indeed, the implementation of the smart classroom concept has brought about new challenges. The widespread adoption of smart classrooms is still in its early stages, and many teachers struggle to adapt to the new teaching methods and technologies. It poses a new challenge for teachers to effectively utilize these resources. Additionally, while small-class teaching improves the quality of education, it also increases the workload for teachers. More teachers are needed to accommodate the smaller class sizes and ensure that all students receive the education they deserve throughout the entire school. You are correct that integrating ideological and political education into professional courses can effectively address this challenge by improving classroom quality and meeting teaching requirements. However, it also brings new challenges. Professional courses primarily focus on students' specialized knowledge, so it becomes crucial to strike the right balance in implementing ideological and political education within these courses. An excessive emphasis on ideological and political education could potentially disrupt the progress of professional courses and impact the overall teaching quality. On the other hand, insufficient attention to ideological and political education would undermine the intended reform goals. Therefore, it poses new requirements and challenges for professional course instructors to navigate this balance effectively.

4. Attempts and Explorations in Course Reform

China University of Petroleum (Beijing), as a domestic university specializing in petroleum studies, is urgently responding to the call of the Ministry of Education to reform ideological and political education. It aims to set an example for other petroleum universities in the country and

play a leading role in accelerating the establishment of a "comprehensive ideological and political education" framework. "Integrating virtue education with talent cultivation" and "comprehensively fostering students' development" are the fundamental requirements and directions for this reform. The major of Oil and Gas Storage and Transportation Engineering is gradually exploring and implementing reforms, paving the way for an ideological and political education reform path that is suitable for the field of oil and gas storage and transportation.

4.1. Introduction of Patriotic Stories of Petroleum Professionals

Every industry has its own heroic figures, and while imparting professional knowledge, it is important to introduce these heroic figures, learn from their heroic deeds, and carry forward their heroic spirit. From the early days of the founding of the People's Republic of China to the present, our country's "Iron Men" have been passed down through three generations. The illustrious figures of Wang Jinxing, Wang Qimin, and Li Xinmin have influenced several generations of Chinese people. Wang Jinxing resolutely led a team to Daqing, saying, "I would rather live twenty years less, but I must seize the Daqing Oilfield by all means necessary." In the sparsely populated and bitterly cold environment of Daqing, an arduous and magnificent oil battle was waged. The term "Iron Man" initially emerged as a praise from local villagers who witnessed Wang Jinxing's work ethic. Gradually, it became a goal for petroleum workers to strive for, and inheriting the spirit of the Iron Man became a personal requirement for every qualified petroleum worker. At that time, Wang Jinxing would work for five days and five nights without returning to the rest area. When he felt tired, he would sleep on the mud tank, using an iron lump as a pillow and covering himself with a sheepskin coat. "Iron Man" was originally a colloquial description of Wang Jinxing's living conditions, but precisely because of its colloquial nature, it could reflect the harsh reality of that time [7]. In the 1970s, Wang Qiming took up the banner of the "Iron Man" and carried it forward, imbuing it with new connotations. The "Iron Men" of this era represent the vast number of petroleum technologists. It is precisely because of these highly skilled and competent workers that our oilfields can achieve "technological advancement in oil production and stable production." Wang Qimin successfully solved a series of core technical challenges in the development and construction of the Daqing Oilfield, making outstanding contributions to maintaining an annual crude oil production of over 50 million tons for 27 consecutive years in Daqing. They led all petroleum workers to carve out a path of development through sheer determination. The phrase "Don't laugh at the young lad; dare to laugh at being the best in the world" truly reflects Wang Qimin's character. They firmly believe that science and technology are the primary productive forces. Taking Wang Jinxing as a role model, subsequent generations have also looked up to him, and it is through his acceptance of the "Iron Man" baton that the spirit of the "Iron Man" has been passed down to this day. During the period of reform and opening up, they bravely scaled new heights and led petroleum workers to continuously improve the quality and output of oil, laying the foundation for the internationalization of our petroleum technology. Li Xinmin, the third-generation "Iron Man," also set Wang Jinxing as his target. Building upon the foundation laid by Wang Qimin, he successfully realized the magnificent aspiration of drilling wells overseas. In Sudan, he created 32 local drilling records in just 8 years. The statement "We are willing to endure countless hardships and dangers to contribute oil to our motherland" reflects their determination to lead the team in drilling one well per person for 13 consecutive years[8]. It is the inspiration of the three generations of "Iron Men" that has shouldered one heavy responsibility after another and overcome numerous challenges in China's petroleum industry. The Daqing spirit and the spirit of the Iron Man, with their main connotations of patriotism, entrepreneurship, pragmatism, and dedication, serve as a powerful spiritual driving force that unites and inspires millions of petroleum workers. It has transcended

beyond the realm of petroleum workers and has become the spiritual essence of the entire nation. It motivates us to move forward and influences our growth. Introducing these stories into the classroom has enlivened the atmosphere and provided students with stronger motivation when facing challenges. It has once again inspired the students. Students are eager to emulate these heroic figures, tackle difficult problems, and cultivate a spirit of inquiry. They aspire to become the next generation of "Iron Men," taking up the banner of the "Iron Man" and passing it on. In the new era of socialism with Chinese characteristics, these stories are endowed with new meanings.

4.2. Cultivating Students' Academic Confidence

Cultivating students' academic confidence is also one of the focal points of the reform in ideological and political education. In the subject of "Elasticity and Plasticity Mechanics," there are numerous formula calculations, and different formulas correspond to different force conditions and boundary situations. For students with a weak foundation in mechanics, this poses significant difficulties and challenges. For them, it becomes a dry and dull course filled with countless formulas. Faced with this challenge, the teaching faculty emphasizes from the very first class that students should do their best to derive the formulas. It is said that it is better to teach someone to fish than to give them fish. Instead of having students memorize formula after formula, it is more effective to teach them how to derive those formulas. For this reason, the teacher invests a significant amount of time in the classroom to teach students the process of derivation. Starting from analyzing boundary conditions and utilizing fundamental equations, students are guided through the derivation process. This approach not only deepens their memory of the subject matter but, more importantly, enhances their academic confidence and desire to acquire knowledge in mechanics. Whenever they successfully derive a difficult formula, they experience a sense of satisfaction and their confidence is boosted. Self-confidence is crucial for self-improvement, and the construction of philosophy and social sciences with Chinese characteristics begins with enhancing academic confidence. Although these achievements in the classroom may not be grand, and can even be described as minor, their impact is profound. Starting from small achievements, it strengthens students' ambition, resilience, and determination, giving them the confidence to shoulder the responsibility of the great rejuvenation of the Chinese nation.

In the classroom, by assigning major projects and even sacrificing some class time, students are encouraged to focus and complete them seriously. Many students tend to treat homework as a chore and may not fully engage with it during their free time. By introducing major projects, students are given the opportunity to participate in discussions and engage in intellectual exchanges. Through these interactions, students may become passionately involved in debating and defending their viewpoints. This process ultimately achieves the true purpose of education. To pursue their own understanding of the truth, students need to dare to question, raise doubts, and be willing to admit their mistakes when they are wrong. Only by daring to challenge others can they discover the truth. Indeed, incorporating real-life knowledge about domestic pipelines into major projects is an indispensable part of enhancing academic confidence. Analyzing practical issues encountered in projects such as the Kuyashan Pipeline and the China-Russia Eastern Pipeline not only deepens students' understanding of these projects but also serves as a means to further enhance their academic confidence. By applying theoretical knowledge to real-world scenarios, students can gain a deeper appreciation of the practical relevance and applicability of their academic studies. This holistic approach strengthens their confidence in their academic abilities and prepares them for future challenges in the field.

4.3. Emphasizing the "Dual Carbon" Goals

Environmental protection has always been a crucial consideration in engineering projects. Especially after the proposal of carbon peaking and carbon neutrality, the petroleum and natural gas industries have faced new challenges due to the impact of new forms of energy. The government has vigorously supported energy conservation and emission reduction efforts, and the petroleum industry is facing a new set of challenges. Against this backdrop, it is essential to prioritize the assessment of pipeline safety risks and minimize them. The "dual carbon" goals will have varying impacts on different regions and populations, and this will inevitably affect fossil energy sources to some extent. You're right [9]. Currently, fossil fuels still account for a significant proportion of our energy consumption. The implementation of the "dual carbon" goals will proceed in a cautious and orderly manner, without radical measures or abrupt changes. It is important for us to respond to national policies and adapt to the requirements of the new era. The stricter the regulations, the more we need to reduce unnecessary carbon emissions and prevent accidents and disasters from occurring at the source. It is crucial to instill in students the recognition that safety in production comes first. By emphasizing this mindset in the classroom, we can provide a solid foundation for the healthy and sustainable development of the petroleum and natural gas industry.

5. Summary

By delving deeper into the ideological and political elements of the oil and gas storage and transportation engineering curriculum, connecting the curriculum with the industry, taking predecessors as role models, resolving relevant practical problems, enhancing students' academic confidence, and integrating with the latest domestic policies, we can implement development plans that are suitable for our own growth. In recent years, the teaching team has continuously scrutinized and designed the ideological and political elements within the oil and gas storage and transportation safety courses, aiming to enhance the quality of ideological and political education in the curriculum and provide conditions for cultivating high-quality talents in the petroleum industry. The ideological and political elements in the oil and gas storage and transportation safety courses go beyond what has been mentioned so far, and further exploration, accumulation, and utilization of these elements are still needed to tirelessly strive for the improvement of educational quality.

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