

Integrating Ideological Education into Mechanical Manufacturing Technology for Vehicle Engineering Majors

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Abstract:

The professional course teaching has shifted from the single imparting of knowledge to an educational paradigm that integrates “knowledge - ability - values” in a three-dimensional manner under the dual circumstances of current engineering education accreditation and the “new engineering disciplines” construction. “Mechanical Manufacturing Technology” is a core supporting course for vehicle engineering major. Its teaching content covers various aspects such as materials, processes, design and management. It is highly practical and socially relevant. The course inherently contains abundant ideological and political education resources. This article is based on the current era background where the new energy vehicle industry is developing rapidly and aligning with the national strategy of becoming a manufacturing powerhouse. It systematically analyzes the existing practical problems in this course’s teaching, such as “excessive content with insufficient class hours”, “abstract theory and disconnected practice”, and “surface-level integration of ideological and political education”. It then deeply explores the ideological and political elements of the course from five dimensions: craftsmanship spirit, innovative thinking, engineering ethics, professional responsibility and patriotism. Based on this, this paper proposes a four-in-one implementation path for course ideological and political education: “content reconfiguration - method innovation - practice deepening - evaluation reform”. It constructs a thought-based education system with “manufacturing power” narrative as the main line. The project-based learning is taken as the carrier. The immersive practice is taken as the platform. The dual-dimensional evaluation is taken as the orientation. The aim is to achieve a deep integration of professional knowledge transmission and value formation, and cultivate high-quality engineering talents who are adaptable to future industrial development and possess both professional skills and spiritual qualities.

Keywords:

Mechanical Manufacturing Technology, Ideological And Political Education, Vehicle Engineering Major, Project-Based Learning, Engineering Ethics

1. Introduction

As the main field for national talent cultivation and scientific innovation, the fundamental task of higher education lies in “moral education and talent cultivation”. In the field of engineering education, with the in-depth advancement of national strategies such as “Made in China 2025” and the “Development Plan for the New Energy Vehicle Industry”, engineering talents should not only possess solid professional foundation and innovative capabilities, but also have firm political beliefs, profound patriotic feelings, rigorous engineering ethics and a strong sense of social responsibility [1]. In 2020, the Ministry of Education issued the “Guidelines for the Construction of Ideological and Political Education in College Courses”, clearly stating that all courses should undertake the function of ideological and political education, and achieve the organic unity of knowledge imparting, ability cultivation and value guidance.

With the rapid growth of the new energy vehicle market, vehicle engineering major has also ushered in new development opportunities. The innovation and application of new energy vehicle technology require a large number of talents with relevant professional knowledge. As a core course for vehicle engineering major, the significance of “Mechanical Manufacturing Technology” is self-evident. This course integrates knowledge from multiple aspects such as engineering materials, material forming, limit fit and mechanical processing technology in its content. Compared with other professional courses, it covers a richer and broader range of content. The course “Mechanical Manufacturing Technology” almost covers the entire life cycle of industrial production and serves as an introductory course for students to understand the manufacturing process of mechanical products. By taking this course, students can not only master the manufacturing process of products, but also broaden their understanding of future employment directions. Therefore, students should not only have the solid theoretical foundation, but also possess certain professional qualities and innovative consciousness. Teachers not only undertake the task of imparting professional knowledge, but also shoulder the mission of cultivating students’ sense of patriotism, engineering literacy and innovative spirit. Driven by the dual tasks of the current national first-class undergraduate major construction and engineering education accreditation, the teaching objective of this course has gone beyond merely imparting knowledge and now places greater emphasis on the all-round development of students.

At present, some scholars have conducted research on the integration methods of ideological and political education and “Mechanical Manufacturing Technology”. Zi et al.[2] introduced the current teaching situation of “Mechanical Manufacturing Technology” and analyzed the ideological and political elements in the course. The ideological and political goals were added into the course and teaching cases for ideological and political education were design. The effective integration of professional knowledge and ideological and political elements were achieved. Jia et al.[3] expounded on the predicament of the traditional teaching mode of “Mechanical Manufacturing Technology”. The core reasons for the poor teaching effect under the current teaching mode were reflected. A new practical teaching model was explored. Yan et al.[4] took the basic course “Mechanical Manufacturing Technology” as the research object to construct a three-dimensional ideological and political element mapping model of “technology - humanities - ethics”. A three-dimensional integrated teaching system of “objectives - content - methods” was designed. Shi et al.[5] proposed the PBL course ideological and political teaching model for “Mechanical

Manufacturing Technology”, which addressed the long-standing disconnection between professional course teaching and ideological and political education.

The paper is based on the training objectives of vehicle engineering major and the requirements of engineering education accreditation. This paper systematically explores the systematic implementation path of ideological and political education in the “Mechanical Manufacturing Technology” course in combination with the author’s many years of teaching experience. The aim is to provide a reference for the ideological and political construction of similar engineering courses.

2. Necessity of Ideological and Political Education and Current Teaching Situation

2.1. Necessity of ideological and political education in courses

The educational demands are changed from “manufacturing giant” to “manufacturing powerhouse”. Chinese manufacturing industry is undergoing a transformation from scale expansion to quality improvement and innovation-driven development. A large number of high-level engineering talents with “craftsmanship spirit”, “innovation consciousness” and “systematic thinking” are urgently needed. Ideological and political education should guide students to establish the belief of “building a manufacturing power” and closely integrate personal growth with national development.

The integration of engineering education accreditation with the fundamental task of “cultivating virtue and nurturing talent” is the logic of educational policies. Engineering education accreditation emphasizes “student-centeredness, output-orientedness, and continuous improvement”. Ideological education is an important means to achieve “moral education outcomes”. Through the integration of ideological education, students can not only master professional knowledge but also form correct views on career, ethics and society.

The logic of student development is the growth empowerment from a “tool person” to a “complete person”. Engineering education should not merely train “technically proficient workers”, but rather cultivate “comprehensive individuals” with critical thinking, humanistic care and social responsibility. Ideological and political education helps students establish professional identity, career sense of mission and cultural confidence by value guidance, thus achieving all-round development.

The technology of new energy vehicles is advancing rapidly. The industry urgently needs highly qualified talents who not only have the solid technical foundation but also possess professional ethics, innovative spirit and social responsibility. By integrating ideological and political elements, students’ professional abilities can be cultivated. At the same time, their ideological and moral qualities as well as their sense of social responsibility can be enhanced. This all-round training model helps to cultivate engineering and technical talents with high sense of social responsibility and strong innovation ability, which meets the demand of the industry for high-quality personnel.

2.2. Current teaching situation

(1) Course schedule

“Mechanical Manufacturing Technology” mainly consists of two major parts: hot working and cold working. The hot working section mainly includes casting, heat treatment, plastic forming and welding. The cold working section mainly includes cutting processing and the design of processing technology regulations. This course consists of 40 class hours, among which 34 hours are for theoretical lessons and 6 hours are for practical sessions. The course content is extensive and the teaching pace is fast. At the same time, ensuring both the quality and quantity of the teaching is a major challenge for this course. How to integrate course ideological education on this basis is also a significant challenge.

(2) Student aspect

The students' basic practical understanding of this course mainly comes from the metalworking practice. However, the metalworking practice mainly provides a superficial understanding of casting, welding and mechanical processing operations. During the theoretical course learning process, students still have great difficulty in comprehending the processing suitability, which leads to a decrease in their learning interest. Although this course covers a wide range of topics, it is not specifically designed for vehicle engineering major. It is difficult for students to deeply understand the course content by traditional teaching methods. Moreover, the relevance of course to the vehicle engineering field is also relatively low.

(3) Teacher aspect

The ideological and political theoretical level of teachers is insufficient. There is a superficial phenomenon in ideological and political education. At present, many ideological and political cases in courses are merely “additional stories” and have not been deeply integrated with the professional knowledge system, which result in limited educational effects.

3. Systematic Exploration and Deep Integration Path of Ideological and Political Elements

3.1. Exploration of ideological and political elements

In light of the characteristics of vehicle engineering major and in accordance with the guidelines in the “Guidelines for the Construction of Ideological and Political Education in Higher Education Courses” issued by the Ministry of Education, the following aspects can be integrated into the ideological and political education of this course:

(1) Promote spirit of craftsmanship and strengthen awareness of quality

By introducing the typical cases from Chinese manufacturing industry, such as the story of mold worker Wang Guangzheng pursuing a precision of 0.01 millimeters, students are guided to understand the craftsmanship spirit of “striving for excellence and being rigorous and focused”. The negative cases such as Toyota's data fraud and Takata's airbag incident can be organized for students to discuss corporate integrity, legal responsibility and professional ethics. The industry consensus that “quality is life” is strengthened.

(2) Stimulate innovative thinking and cultivate aspiration to serve the country

By integrating teaching contents such as heat treatment processes and material selection, the significance of technological innovation for the upgrading of the

national manufacturing industry is elaborated. Students are encouraged to propose vehicle improvement plans from the perspectives of drivers and passengers, such as enhancing battery range or developing antibacterial materials, in order to cultivate their awareness of observing life and daring to innovate. Students are helped to understand the crucial roles of teamwork and professional ethics in engineering practice by introducing the actual difficulties encountered in the university-enterprise collaborative research and development (R&D) projects.

(3) Integrate engineering ethics and enhance professional responsibility

When explaining the processing techniques and production procedures, the responsibility of each step is stressed. Students are guided to establish the awareness that “the position implies responsibility”. Through the cases such as the leaking of Mercedes-Benz vehicles, this discussion explores corporate social responsibility, consumer rights protection and brand trust building, which aims to enhance students’ legal awareness and professional ethics.

3.2. Implementation path of ideological and political education that integrates industrial demands

Based on the development trend of the new energy vehicle industry and the requirements for education, the ideological and political education construction of “Mechanical Manufacturing Technology” course needs to go beyond simple case additions and undergo a systematic teaching reorganization. The core lies in deeply integrating national strategies, industrial demands, professional ethics and professional knowledge to achieve an upgrade from “ideological and political cases” to “ideological and political education systems”. The advanced experience of domestic universities are drawn on to explore the four specific implementation paths.

(1) Reconstruction of course content: Connect the knowledge system with the narrative of a “manufacturing power”

The traditional straightforward approach is changed and the grand narrative of “building a powerful nation” is taken as the main thread to reconstruct the teaching logic. For instance, when explaining “material forming”, the story of the breakthrough in the precise forming technology of the entire fuselage wall panels of Chinese large passenger aircraft C919 can be incorporated. The imparting of knowledge is synchronized with the value guidance of “self-reliance and strength in science and technology” by integrating the material properties, process selection and the demands of major national projects. The School of Mechanical Engineering of Xi'an Aeronautical University has systematically explored the ideological and political elements contained in 186 knowledge points of the “Fundamentals of Mechanical Manufacturing Technology” course, and integrated 35 professional ideological and political cases. The ideological and political educations are taken into plans, syllabuses, teaching plans and classrooms, which are achieved comprehensive integration. This kind of reconstruction requires teachers not merely to add stories but to re-examine and reinterpret the inherent logic and contemporary value of professional knowledge, which is based on the demands of the country.

(2) Innovation in teaching methods: Drive value internalization through project-based learning

The “ideological and Political Education + project-based Teaching” (PBL) model is adopted, which is an effective way to promote ideological and political education to

be deeply rooted in people's minds. Teachers can design comprehensive projects such as "Lightweight Design and Process Optimization of High Energy Density Battery Casings" and "Precision Processing and Heat Treatment Process Formulation of Drive Motor Shafts" around the key links of the new energy vehicle industry chain. The students work in groups throughout the entire process from drawing design, process planning to virtual simulation or practical operation. During this process, they not only comprehensively apply knowledge such as engineering materials, limit fits and mechanical processing, but also deeply understand the engineering ethical connotations of rigor, collaboration, integrity and innovation. The "Design and Manufacturing II" course at Shanghai Jiao Tong University adopts the "the dual main lines of product development-driven projects and classroom teaching run in parallel" model to guide students to discover real social needs and design machines independently. This has successfully cultivated students' systems thinking and the responsibility of "serving the country through science and technology". This "learning by doing and acting by understanding" approach enables ideological and political education to naturally occur in the process of solving complex engineering problems.

(3) Deepening of practical teaching: Strengthen professional identity through "immersive experiences"

The practical link is the "golden classroom" of ideological and political education in courses. We should go beyond the conventional metalworking practice and create an "immersive" ideological and political practice. On the one hand, the experience of North China University of Technology can be drawn upon. During production internships, on-site research and study of "major national equipment" can be integrated. For instance, when visiting new energy vehicle production lines or key component enterprises, the collaborative operation of intelligent robots and the hot stamping forming process of ultra-high strength steel can be emphasized. This will directly connect classroom theories with the cutting-edge of the industry and stimulate students' professional pride and sense of mission. On the other hand, virtual simulation and other digital intelligence technologies can be actively utilized to build a "Red Project Virtual Laboratory" or develop AI courses. The manufacturing scenarios of major equipment or the process of tackling technological difficulties can be recreated. This enables students to experience the power of the craftsmanship spirit across time and space. The STEP teaching model (Simulation, Theory, Experiment, Project) established by the School of Mechanical Engineering at Beihang University is a prime example of digital intelligence empowering ideological and political education and forming a closed loop of learning and practice.

(4) Reform of the evaluation system: Driving all-round development with "dual-dimensional assessment"

The traditional single knowledge assessment cannot evaluate the effectiveness of ideological and political education. A dual-dimensional comprehensive evaluation system of "professional ability + ideological and political quality" must be established. Specifically, during the review of project reports, additional evaluations can be added regarding "ethical considerations in the design process", "team collaboration and communication performance", and "the embodiment of sustainable manufacturing concepts". In the course summary, students are encouraged to write learning reflections or career planning reflections that combine industrial cases. At Beijing Institute of Technology, in the mechanical courses, the school incorporates the sense of responsibility that students demonstrate in scientific and technological innovation

projects and competitions, as well as their innovative spirit of overcoming difficulties, into the assessment scope. This evaluation reform sends a clear signal to students that both professional skills and professional character are equally important to become an outstanding engineer.

3.3. Teaching implementation example: Take the “Manufacturing process of Drive shafts for New Energy Vehicles” as an example

(1) Teaching content design

a. Knowledge module: Material selection for shaft parts → heat treatment process → precision machining → inspection and assembly.

b. Main thread of ideological and political education: The development history of Chinese automotive component industry from “contract manufacturing” to “independent design”.

c. Core case: Analysis of a quality accident of drive shaft fracture in a domestic electric vehicle (incorporating responsibility and ethics education).

(2) Classroom organization process

a. Context introduction: Play a video about the growth of Chinese new energy vehicle market and introduce the topic of “core component autonomy”.

b. Teaching: Explain the manufacturing process by combining real objects, animations and factory scene videos.

c. Group discussions: Discussion centered on “How to enhance the reliability and lifespan of drive shafts through process optimization”.

d. Obvious value: Guide students to summarize the cognitive chain that “craftsmanship determines quality, quality determines brand, and brand is related to the national image”.

(3) After-school extended tasks

The essay of “The Professional Ethics and Social Responsibility of Craftsmen” is required, which is no less than 800 words. The course content and own insights are integrated to elaborate on your understanding of “Engineering for the People”.

4. Evaluation and Continuous Improvement Mechanism

4.1. Dimensions of effectiveness evaluation

(1) Student feedback: Students’ cognition and acceptance of the guidance of course values are understood through questionnaires and interviews.

(2) Learning outcomes: The engineering ethics awareness and innovative thinking reflected in project reports, course papers and experimental records are analyzed.

(3) Behavior observation: Students’ professional qualities and sense of social responsibility demonstrated in subsequent courses, competitions and internships are tracked.

4.2. Continuous improvement mechanism

(1) Improvement of teachers' ideological and political capabilities: Teaching discussions on ideological and political education, case sharing, and joint lesson preparation by schools and enterprises are regularly carried out.

(2) Dynamical update of teaching resources: A case library for ideological and political education, a video library, and a real-scene resource library of enterprises are established.

(3) School-enterprise collaborative education: The enterprise engineers are invited to participate in course design, project review and career lectures to enhance the contemporaneity and effectiveness of teaching.

5. Conclusions

Facing the profound transformation of new energy vehicle industry from being driven by “technological innovation” to “ecological reshaping”, the ideological and political construction of “Mechanical Manufacturing Technology” course in Vehicle Engineering major is undergoing a crucial transition from “passive integration” to “active leadership”. The fundamental approach lies in placing the curriculum within the national strategic framework of “building a manufacturing power”. The integration of industry and education is applied as a mirror to discern the genuine demands of the industry. The project practice is taken as a path to hone students' genuine skills. The value shaping is taken as the soul to fortify their true faith in serving the country. Only through the multi-pronged approach of reconstructing course content, innovating teaching models, deepening practical links and reforming the evaluation system can truly break the dilemma of the separation between ideological and political education and professional education. The classroom for knowledge transmission is elevated to a crucible for value shaping. The solid foundation is established for cultivating outstanding engineering talents capable of shouldering the great responsibility of national rejuvenation and leading the development of future industries.

Conflicts of Interest

The authors declares that there is no conflict of interest regarding the publication of this article.

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References

- [1] Chang, Y.; Wang, R.; Tian, L. et al. Ideological and Political Teaching Practice for the Fundamentals of Mechanical Manufacturing Technology Course Based on Engineering Education Accreditation. *Journal of Science and Education*, 2024, 10, 77-80.

- [2] Zi, N.; Yan, F.; Meng, K. Ideological and Political Reform and Research of Mechanical Manufacturing Technology Course from the Perspective of Three-dimensional Education. *AUTO TIME*, 2025, 01, 96-98.
- [3] Jia, X.; Chen, K.; Xing, J. Exploration On the Teaching Reform Scheme of “Mechanical Manufacturing Technology” Driven by the Integration of Science and Education and the Integration of Industry And Education. *Technology Wind*, 2025, 08, 59-61.
- [4] Yan, X.; Li R.; Zhai P. et al. Exploration and Practice of Ideological and Political Teaching Reform in the Basic Course of Mechanical Manufacturing Technology. *Machine China*, 2025, 22, 152-155.
- [5] Shi, L.; Zhou J.; Fang, G. et al. Exploration of Ideological and Political Education in Mechanical Manufacturing Technology Courses under the Background of Grand Ideological and Political Education. *Journal of Social Science of Jiamusi University*, 2024, 42(06), 165-168.



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