

Research on the Organic Integration Path of Ideological and Political Teaching Elements in Mechanical Design Courses in Universities

Dan Xu

Geely University of China, Chengdu, Sichuan, 641423, China

ABSTRACT

With the deepening of national strategies such as "Made in China 2025", simply imparting technology is no longer sufficient to meet the training needs of engineering and technical talents in the new era. The "Guiding Outline for Ideological and Political Construction of Higher Education Curriculum" issued by the Ministry of Education clearly proposes to comprehensively promote ideological and political construction of curriculum, integrating value shaping, knowledge imparting, and ability cultivation. As a mechanical engineering course, mechanical design covers the entire process from basic theory to engineering practice, and naturally has the advantage of carrying out ideological and political education. The rigorous and practical scientific spirit, the pursuit of excellence in craftsmanship, and the sense of responsibility for innovation and breakthroughs contained in the course are all essential core competencies for engineers in the new era.

KEYWORDS

Universities; Mechanical design; Course Ideology and Politics

1 Introduction

The ideological and political construction of mechanical design courses is closely related to the quality of talent cultivation and the strategy of building a strong manufacturing country. In this context, exploring the organic integration path of ideological and political elements in mechanical design courses and building a ideological and political education model with engineering education characteristics have important theoretical value for improving the quality of talent training in China and serving the national innovation driven development strategy.

2 Teaching characteristics of mechanical design course

As a core course in mechanical engineering, the course of mechanical design has a distinct engineering practicality. Its teaching content includes basic theories such as structural mechanics and mechanical analysis, as well as practical skills such as component design and standard selection. The knowledge system of this course presents a typical pyramid structure, from the bottom level of mathematical and physical foundations to the middle level of professional theoretical knowledge, and finally to the top level of comprehensive innovative design. The progressive knowledge framework provides a natural carrier for the infiltration of ideological and political elements. The design cases in the course often come from engineering practice, from simple threaded connectors to complex automated production lines, and every detail contains opportunities for ideological and political education such as engineering ethics and quality awareness. The development process of mechanical design itself is a history of dialogue between human intelligence and natural laws. From ancient waterwheels to modern aerospace institutions, the humanistic spirit behind technological evolution provides a rich treasure trove of materials for ideological and political education courses. The course emphasizes the characteristics of teamwork in completing design tasks, and also creates practical scenarios for cultivating students' cooperative awareness. Against the backdrop of rapid technological development, the cross integration of mechanical design courses with emerging fields such as information technology and artificial intelligence has also given rise to new ideological and political issues such as data security. The discipline's characteristic of keeping up with the times requires ideological and political education to keep pace with professional and technological development.

3 Problems in the integration of ideological and political education into mechanical design courses in current universities

3.1 Content level

The integration of ideological and political education into the content design of current mechanical design courses still faces problems of superficiality and fragmentation. Some teachers simply mechanically overlay ideological and political elements on professional knowledge, insert a patriotic education video at the beginning of the classroom, or rigidly cite policy documents, failing to achieve an organic integration of professional knowledge and value guidance. The selection of ideological and political cases is often limited to traditional materials, and ideological and political education is disconnected from industry development. The infiltration method of ideological and political education in courses is relatively single, relying more on teachers' oral lectures, which makes ideological and political education superficial and difficult to stimulate students' deep thinking. Although some universities have added ideological and political objectives to their curriculum outlines, there is a lack of systematic planning in their implementation, and the ideological and political content in each chapter is loosely connected, failing to form a value guidance mainline that runs through the entire curriculum.

3.2 Teacher level

Mechanical design teachers generally have a solid engineering background, but lack a systematic understanding of the teaching methods of ideological and political education. Some teachers still have a fragmented thinking of "professional to professional, ideological and political to ideological and political", believing that values education should be the responsibility of ideological and political course teachers. Teachers face a lack of ability when exploring ideological and political elements in the curriculum, making it difficult to extract suitable ideological and political entry points from technical details such as institutional design and material selection, resulting in case explanations that are sometimes too far fetched or vague. The ideological and political training for professional teachers in universities is mostly focused on policy interpretation, lacking practical guidance tailored to the characteristics of engineering courses. Some teachers also lack enthusiasm for investing in ideological and political construction due to the evaluation and appointment mechanism, and have a mentality of "coping with inspections", making ideological and political education superficial.

3.3 Mechanism level

At the time of promoting ideological and political education in courses, universities have not yet established effective collaborative mechanisms, and the curriculum evaluation system is still centered on knowledge. The assessment indicators for the effectiveness of ideological and political education are vague, and dimensions such as team collaboration performance have not been included in the scoring criteria, making it difficult to form positive incentives. The teaching management system lacks sufficient support for the integration of ideology and politics, such as the allocation of experimental class hours not leaving time for value discussions, and the lack of clear requirements for incorporating ideological and political cases in textbook editing and review, resulting in a lack of institutional guarantees for teachers in the implementation process. The lack of linkage mechanism for ideological and political education in school enterprise cooperation has led to a disconnect between classroom ideological and political education and social practice, as enterprise mentors focus more on technical skills when guiding students' internships, while neglecting the cultivation of professional responsibilities and other qualities.

3.4 At the student level

The acceptance of ideological and political education courses by students shows polarization, with some students having inherent biases towards the content, believing it to be "hollow preaching". In practical aspects such as gear transmission design, students are more concerned about the accuracy of parameter calculations and lack interest in exploring the historical evolution of tolerance fit national standards, reflecting a lack of understanding of the deep value of technical specifications. Students are more concerned about the professional skills required for employment, and have a weaker perception of the need to improve their ideological and political literacy. The new generation of students who grow up in a digital learning environment are more easily attracted to the real-time feedback of CAD modeling, and have a lower acceptance of the ideological and political connotations that require deep thinking. The cognitive habits of the new generation of students have also put forward new requirements for ideological and political education. The

fragmented reading mode in the era of short videos makes students lack patience for long case studies, and the traditional "teacher lectures, students listen" indoctrination style ideological and political education is difficult to resonate with.

4 Path design for integrating ideological and political elements into mechanical design courses

4.1 Optimization and integration of course content

The integration of ideological and political elements into mechanical design courses must achieve deep coupling with professional knowledge. In the theoretical teaching process, the introduction of ancient Chinese technological achievements can be combined with the analysis of institutional motion, such as the correlation analysis between the lever principle of Zhang Heng's seismograph and modern shock absorption devices, which not only explains the laws of mechanics but also demonstrates cultural confidence. Integrating standardization awareness into component design teaching, guiding students to understand the national industrial security behind technical standards by comparing the evolution of thread tolerance systems at home and abroad. The chapter on material selection can incorporate the concept of sustainable development, analyze the carbon emission data of different metal processing techniques, and enable students to naturally form an awareness of environmental responsibility in technical decision-making. The course design topics can be set in conjunction with major national needs, such as developing auxiliary mechanical devices for an aging society, integrating humanistic care into innovative practices, and adding an ideological and political column in textbook revisions to present the spirit of scientists in the history of mechanical engineering, team collaboration cases in major equipment research, etc. in the form of "extended reading", forming a visible hidden ideological and political content system.

4.2 Innovative integration of teaching methods and carriers

Traditional indoctrination based teaching is difficult to adapt to the organic infiltration of ideological and political elements, and it is necessary to construct multidimensional and three-dimensional teaching scenarios. Project based learning can set up a "bottleneck" technology breakthrough scenario, such as guiding students to design alternative bearing sealing structures in groups, and cultivating independent innovation awareness in the process of technological breakthroughs. The practical teaching segment can organize a themed research on "Red Machinery" to trace the history of equipment renovation in military factories during the Anti Japanese War, making workshop training a patriotic education site. The construction of digital platforms is particularly important, building a case library of ideological and political courses, classifying them according to tags such as "innovation driven", "craftsmanship spirit", and "ethical norms", and supporting teachers to flexibly access multimedia resources such as animations and engineering drawings. The flipped classroom model is suitable for conducting value collision discussions, such as debating the issue of "artificial intelligence replacing traditional mechanical design" and establishing a humanistic scale of technological development through speculation.

4.3 The path of teacher team construction

The improvement of teachers' ideological and political teaching ability requires breaking down disciplinary barriers and building a long-term development mechanism. Implement the "dual mentor system" cultivation plan, equip professional teachers with Marxist theory mentors, and establish "curriculum ideological and political workshops" to organize teachers to analyze typical teaching segments, such as extracting teaching strategies for cost control and business ethics from gearbox design cases, and enhancing their ability to explore ideological and political elements through collective lesson preparation. The two-way flow of talents between schools and enterprises is very important. Universities can arrange teachers to practice in enterprises such as CRRC and Sany Heavy Industry, collect stories of team breakthroughs in shield tunneling machine research and development, and use ideological and political materials from the front line of the industry to feed back into classroom teaching. Improve incentive mechanisms, incorporate the effectiveness of ideological and political education into the criteria for professional title evaluation, establish special rewards for "Course Ideological and Political Demonstration Courses", and stimulate teachers' intrinsic motivation. Establish interdisciplinary teaching and research teams, unite professional forces such as philosophy and sociology, and help teachers establish a broader perspective on ideological and political education.

4.4 Improve the course evaluation mechanism

A scientific evaluation system is the baton for the continuous deepening of ideological and political education, which needs to break through the single technical indicator orientation and form a quality monitoring loop that runs through the entire teaching cycle. The evaluation of students' understanding of knowledge at the basic level needs to add an ideological and political dimension. For example, in the grading of routine institutional design assignments, in addition to examining the correctness of kinematic analysis, the depth of students' understanding of key knowledge points should be synchronously evaluated to achieve synchronous assessment of professional skills and value cognition. At the intermediate level, it is necessary to improve the process evaluation tools: the technical dimension focuses on the engineering feasibility of the design scheme, the literacy dimension examines the sense of responsibility in team collaboration, and the value dimension evaluates the responsiveness of the scheme to social needs, making the effectiveness of ideological and political education visualized. At the level of outcome evaluation, establish a school enterprise joint graduation requirement achievement evaluation mechanism, invite enterprise experts to participate in defense scoring, focus on examining students' professional qualities such as engineering ethics awareness and cost control thinking reflected in curriculum design, and ensure accurate alignment between talent cultivation and social needs.

5 Countermeasures and suggestions for promoting ideological and political construction in mechanical design courses

5.1 Clarify the top-level design objectives of ideological and political education in the curriculum

The ideological and political construction of mechanical design courses must be systematically planned from a strategic perspective, and a multi-level goal system must be constructed. At the institutional level, it is necessary to incorporate ideological and political requirements into talent training programs, clarify the educational positioning of emphasizing both technical literacy and value shaping in mechanical majors, develop the "Guidelines for Ideological and Political Construction of Mechanical Design Courses", and refine the standards for integrating ideological and political education into each teaching process. The curriculum team should take the lead in developing the teaching outline, adding a "value guidance" column outside the traditional knowledge module, and adding measurable ideological and political goals that can analyze responsibility in component failure cases and consider resource conservation and environmental friendliness in scheme design, in addition to the traditional design calculation ability requirements, so that value guidance can be effectively implemented. Establish a dynamic adjustment mechanism, regularly update ideological and political goals in accordance with national strategic needs, such as adding green design evaluation indicators in response to the "dual carbon" strategy, so that the curriculum always resonates with the pulse of the times. Resource construction should highlight the characteristics of mechanical design and develop an ideological and political material library that includes typical mechanical failure cases, such as the lessons learned from standard execution in pressure vessel bolt fracture accidents, quality control inspirations behind early failure of wind power gearboxes, and other real engineering cases. At the same time, a course ideological and political guidance committee composed of teaching deans, professional leaders, and ideological and political experts should be established to regularly supervise the reflection of ideological and political elements in teaching archives, ensuring that top-level design is not compromised and transformed into teaching practice.

5.2 Encourage teachers to participate in ideological and political practice in the curriculum

To promote the deep participation of teachers in the construction of ideological and political education in the curriculum, a progressive cultivation system should be constructed. In the cognitive enlightenment stage, by organizing experts in the field of mechanical design and ideological and political teachers to jointly carry out a special seminar on "Value Penetration in Component Design", professional teachers can understand the natural connection between the rigorous style of thread anti loosening design, reliability thinking in bearing selection, and ideological and political elements, and break the misconception that mechanical design does not require ideological and political education. The key focus of the ability enhancement stage is to carry out relevant training for dual teachers, arrange professional teachers and industry engineers to jointly develop typical cases, such as explaining quality responsibility awareness in combination with high-speed rail gearbox failure analysis, and exploring intellectual property protection through 3D printing technology prototype design. At the practical application level, implement the "Three Ones" project: each

teacher should create at least one mechanical design ideological and political demonstration case every semester, record one micro lesson video incorporating ideological and political points, and guide one course design that reflects engineering ethics. In terms of incentive and guarantee, a multidimensional evaluation system will be established to include the quantity and quality of ideological and political cases developed by teachers in mechanical design courses in teaching assessments. A special reward of "Best Ideological and Political Integration Teaching Plan Award" will be set up, and innovative designs with social value guided by students will be added as bonus points for job title evaluation, ultimately forming a virtuous cycle from teaching practice to achievement accumulation and career development.

5.3 Introducing real engineering cases to enrich teaching content

Real scenario engineering cases are a natural bridge connecting professional education and value education, and should be systematically integrated into the entire teaching process. Collaborative development of teaching resource library between schools and enterprises, selecting engineering examples with ideological and political value, such as the technological breakthrough story in the research and development of high-speed rail bogies and the independent innovation process of aerospace robotic arms, presented in the form of video interviews, 3D models, etc., to concretize abstract values. Innovative case teaching method, using project review mode to analyze major projects, such as equipment innovation in the installation of immersed tubes for the Hong Kong Zhuhai Macao Bridge. Practical teaching can incorporate real topics and collaborate with equipment manufacturing enterprises to set up technical difficulty improvement projects, allowing students to experience the urgency of independent innovation in solving practical problems. Establish a case update mechanism, keep up with the latest technological trends, such as timely transforming new propositions such as algorithm bias in artificial intelligence mechanical design into teaching materials, maintain the timeliness of ideological and political education, and make the engineering site the most vivid ideological and political classroom through two-way communication such as enterprise mentors entering the classroom and students entering the workshop.

6 Conclusion

Guided by the fundamental task of cultivating moral character in higher education in the new era, the value shaping in engineering education has become more urgent than ever. From "Made in China 2025" to the construction of "New Engineering", the national strategy has put forward higher requirements for engineering and technical talents with both innovation ability and patriotism. Mechanical design, as the main core course of mechanical majors in universities, embodies the rigorous and practical scientific spirit, the refined craftsmanship quality, and the mission of serving the country through industry. It is an important carrier to respond to the challenges of the times. The profound value of ideological and political education in courses lies in awakening the humanistic dimension in engineering education, enabling warm value pursuits to leap behind the cold mechanical principles, and enabling future engineers to always maintain their responsibility to society, reverence for nature, and inheritance of civilization while mastering advanced technology.

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