How to Uncover Ideological and Political Elements and Integrate Them into the Entire Teaching Process of Professional Courses

-- A Case Study of the Course *Principles and Engineering of Papermaking*

Dongmei Yu, Ronggang Li, Chaojun Wu, Xingxiang Ji

Department of Light Industry QILU UNIVERSITY of TECHNOLOGY, Jinan, Shandong, China

Abstract

The construction of curriculum-based ideological and political education is a key measure for implementing the fundamental task of fostering virtue through education. Taking the course *Principles and Engineering of Papermaking* as an example, this paper systematically explores the principles and methods for uncovering ideological and political elements in professional courses and their integration pathways throughout the teaching process. By analyzing the alignment between course content and ideological-political education, corresponding ideological-political objectives are distilled. A comprehensive integration strategy covering "pre-class, in-class, post-class, and practical" stages is designed, and a teaching method combining "implicit infiltration and explicit guidance" is proposed. Teaching practice indicates that this model effectively enhances students' professional identity, engineering ethics awareness, and sense of social responsibility, providing a reference paradigm for ideological-political construction in engineering professional courses.

Keywords

Curriculum-based Ideological and Political Education; Principles and Engineering of Papermaking; Uncovering Ideological-political Elements; Teaching Integration.

1. Introduction

Against the backdrop of the construction of emerging engineering disciplines, the deep integration of professional education and ideological-political education has become an important direction in the reform of higher engineering education. As a core course in the Pulp and Paper Engineering major, *Principles and Engineering of Papermaking* not only carries the professional mission of imparting knowledge on papermaking technological principles, process design, and production management but also contains rich resources for ideological-political education. How to effectively uncover ideological-political elements within this technical and engineering content and organically integrate them into the entire teaching process, achieving the unity of knowledge imparting, ability cultivation, and value guidance, is an urgent issue to be addressed in the current reform of professional course teaching.

2. Principles for Uncovering Ideological-Political Elements in Professional Courses

Curriculum-based ideological-political education is not about simply adding political indoctrination to professional courses[1,2]. Instead, it is based on the internal logic of the professional knowledge system, uncovering the values, ways of thinking, and spiritual guidance contained within. During their studies, students acquire not only explicit knowledge and skills but also attitudes, values, and beliefs through "hidden curricula" such as campus culture, teacher-student interaction, and teaching methods.

The essence of uncovering ideological-political elements is extending values education from "explicit ideological-political courses" to "implicit professional courses." It emphasizes integration through subtle influence, transmitting value orientations via teachers' words and deeds, the selection of course cases, and the creation of classroom atmosphere. Following the Outcomes-Based Education (OBE) concept advocated by engineering accreditation, ideological-political objectives for the course should first be clarified[1]. Subsequently, corresponding ideological-political elements embedded in the course content are uncovered. When designing the ideological-political component, the primary consideration should be: what kind of individuals, in terms of values, character, and key competencies, do we hope the students will become through this course? This constitutes the top-level design. Clear objectives provide direction and focus for uncovering ideological-political elements that match these goals from the course content, teaching resources, teaching methods, and assessment, avoiding blind and random presentation of these elements. Setting objectives first also helps construct a well-structured, focused ideological-political education system, rather than a haphazard accumulation of elements.

Instructors can uncover ideological-political elements by analyzing course content and teaching resources, then examine and enhance them using the ideological-political objectives: Which educational goal does this element primarily serve? How can it be designed to better achieve that goal? During this process, initial objectives might be found too broad and require adjustment. Alternatively, some uncovered elements might hold value beyond the original objectives, prompting supplementation or revision of those objectives. Both ideological-political objectives and elements are crucial for curriculum-based ideological-political construction. The principle of "objective-first" should be upheld, while a two-way interaction where elements inform and optimize objectives must be maintained during implementation (Figure 1). Ultimately, this allows for an organic unity between objectives and elements within the course, like salt dissolving in water-a fusion process that begins with objective orientation and succeeds through two-way interaction and complementarity.

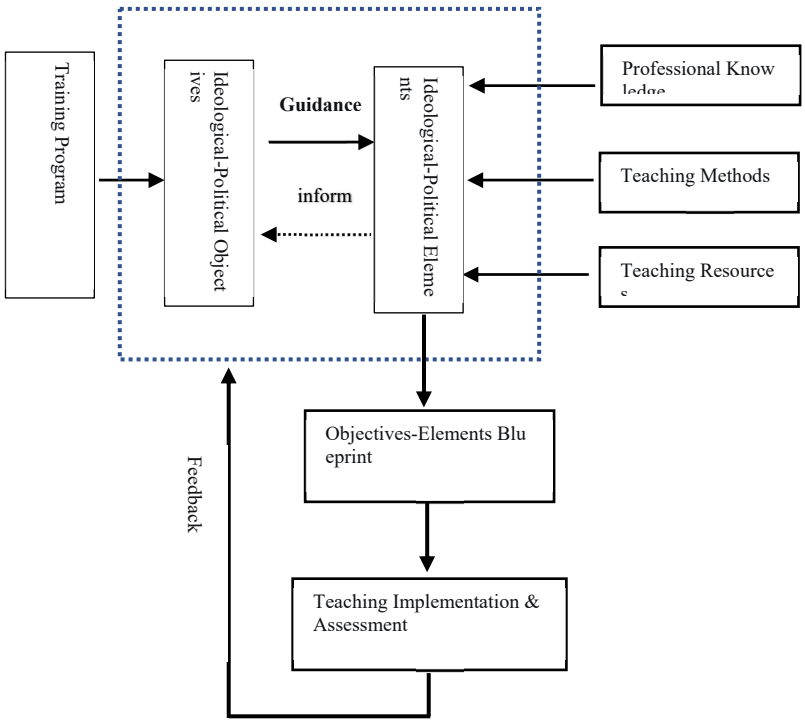

Figure 1. Two-Way Interactive Relationship Between Ideological-Political Objectives and Elements

Table 1. Ideological-Political Objectives-Elements Blueprint for Principles and Engineering of Papermaking

Ideological-Political Objective	Chapter Content	Key Knowledge Points	Ideological-Political Elements & Entry Points
Patriotism and Dedication	Pulp Approach Flow and Sheet Formation	Structure, Types, and Development of Headboxes	The struggle from complete reliance on imports to gradual localization of core components like high-speed paper machine headboxes inspires students' national pride and ambition to contribute to high-end equipment R&D, assisting Chinese manufacturing in achieving a "corner overtaking."
	Pressing and Drying of Paper Web	Principles of Drying Process & Factors Affecting Drying	The drying section is a major "energy consumer" in paper mills. Guiding students to understand, through innovations like heat pump technology, the direct connection between their major and national strategic goals like "Carbon Peak and Carbon Neutrality," fostering a sense of mission to "write their theses on the land of the motherland" and contribute to the industry's green transformation.
	Paperboard Manufacturing	Structural Characteristics & Quality Control of Paperboard	Paperboard is a "barometer" of the national economy, vital to logistics, e-commerce, and manufacturing. Guiding students to recognize the foundational role of the light industry in national industrial and supply chain security, understanding the profound meaning of "small paper supporting large circulation," enhancing pride in serving the real economy.
Responsibility and Accountability	Beating	Impact of Beating on Sheet Properties	Good paper is "beaten" out. Guiding students to understand how a single incorrect beating parameter can lead to defects in an entire batch, cultivating their rigorous attitude that "details determine success or failure" and overall awareness of responsibility towards downstream processes. This forms the most basic and direct product responsibility of an engineer.
	Paper Machine Stock and Water Systems	White Water System & Closed Water Circulation in Papermaking	The stock-water system is the "circulatory kidney" of a paper machine. Guiding students to recognize that optimizing this system for water saving and emission reduction is not merely a cost issue but a direct embodiment of engineers fulfilling environmental regulations, practicing green development concepts, and being accountable to the ecological environment.
	Pressing and Drying of Paper Web	Main Factors Affecting Press Dewatering & Enhancement Methods	Guiding students to recognize that optimizing pressing processes, improving efficiency, and reducing steam consumption in drying are not only cost-related but also direct reflections of responsibility towards the ecological environment, reinforcing a sense of responsibility in engineering practice.
Craftsman Spirit	Beating	Beating Process	Designing differentiated beating processes according to the fiber characteristics of different raw materials, achieving precise control over fiber cutting and fibrillation through accurate regulation of refining pressure, consistency, and time, embodying the craftsman spirit of respecting material nature and pursuing excellence.
	Papermaking Chemicals and Their Application	Wet-End Chemicals	Paper production requires adding various chemicals, which may have synergistic or interfering effects. Guiding students to understand the relationships between components like in Traditional Chinese Medicine formulation, continuously optimizing combinations, reflecting a scientific attitude of upholding integrity while innovating.
	Pulp Approach Flow and Sheet Formation	Main Development History & Representative Types of Headboxes	The evolution of headboxes from open, closed, hydraulic, to multi-layer types is essentially the progression of control precision for basis weight profile, fiber orientation, and stock consistency uniformity from the millimeter to the micrometer level, from macro to micro. This highlights the craftsman spirit of never being satisfied and constantly challenging physical and manufacturing limits.

Following the above principles and based on the training requirements for talents in the Light Industry major (Pulp and Paper direction), three major ideological-political objectives are condensed: **"Patriotism and Dedication," "Responsibility and Accountability,"** and **"Craftsman Spirit."** These three teaching objectives systematically correspond to the core requirements of "all-round development in moral, intellectual, physical, aesthetic, and labor education" and "high-quality application-oriented talents" in the professional training objectives from the three dimensions of industry mission, personal value, and engineering practice, achieving the organic integration of ideological-political education and professional education. Table 1 presents the blueprint of ideological-political objectives and corresponding elements for the course *Principles and Engineering of Papermaking*.

3. Implementation Pathways for Integrating Ideological-Political Elements into the Entire Teaching Process

3.1. Pre-class-Creating Ideological-Political Context

Creating an ideological-political context before class serves as the "overture" and "setting" for curriculum-based ideological-political education. It aims to stimulate interest, provoke thought, and set the emotional tone, allowing students to develop a preliminary resonance at the value level with the professional content to be discussed before formal learning begins. For example, before explaining beating equipment, a short video clip from “Tiangong Kaiwu” depicting ancient papermaking techniques like "cutting bamboo, soaking in ponds, and cooking in vats" along with a technical introduction to high-consistency beating in large enterprises can be shared. Students are asked to describe in a paragraph: What has changed from "mortar pounding" to "disc refining"? What remains the unchanging core pursuit? This guides students to appreciate the long-standing wisdom of the Chinese nation in the field of papermaking and the vitality of modern technological innovation, understand the "change and constancy" of the "craftsman spirit," and establish cultural confidence and innovation confidence.

3.2. In-class Infiltration and Integration

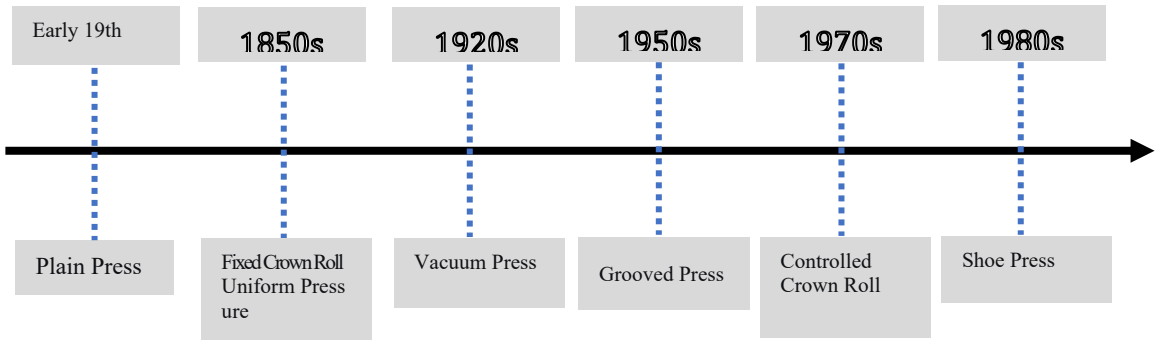

Figure 2. Schematic Diagram of the Evolution of Core Pressing Technologies

In-class infiltration and integration are primarily achieved through two approaches: the natural connection between knowledge points and ideological-political elements, and the implicit inclusion of these elements in teaching method design[3]. For instance, by tracing the development history of a certain technology, the spirit of generations of engineering personnel who persevered through difficulties and courageously shouldered responsibilities can be showcased, achieving a natural connection between professional knowledge and a sense of accountability. When teaching the history and development of the press section, the clear historical progression shown in Figure 2 can illustrate how press technology evolved

step by step from inefficient plain press to the shoe press used in modern high-speed paper machines. Each generation of technology, after a period of application, encounters bottlenecks that cannot meet production development, sowing the seeds for the next generation—difficulties imply opportunities. This guides students to understand that both in life and engineering practice, encountering difficulties often signals new opportunities; we should face challenges without fear and bravely shoulder the responsibility for innovation.

In teaching methods, analogy and transfer can be used to integrate professional knowledge with ideological-political elements. For example, when explaining how paper strength is developed during the papermaking process, students are guided to conduct a comprehensive analysis from raw materials to the production process: the increase in paper strength accompanies the dewatering of the wet web, with strength rising rapidly in the drying section. The underlying reason is the formation of numerous hydrogen bonds between fibers. While a single hydrogen bond is weak, the collective action of a vast number of them imparts excellent strength properties to paper. This is akin to how individual human power is limited, but unity of purpose can converge into a formidable force driving national rejuvenation and prosperity.

3.3. Post-class Extension

Effectively extending the ideological-political elements uncovered in class to post-class activities is key to deepening educational impact and internalizing values. A multi-dimensional post-class ideological-political system of "reflection and deepening – cultural immersion" should be constructed, which can be facilitated through online platforms. For instance, a course learning group can be established to regularly share interviews with industry leaders, stories of outstanding alumni, industry hotspots, and cutting-edge developments. Students are encouraged to write brief reflections. Instructors provide timely feedback, affirm positive expressions, and showcase excellent reflections within the group to promote exchange and foster a favorable atmosphere of cultural immersion.

3.4. Course Assessment and Feedback

The integration of ideological-political performance into course assessment can be reflected in both process assessment and final testing. Process assessment assignments should emphasize the integration of ideological-political elements. For example, after teaching about papermaking fibrous materials, a small assignment on "Investigation into the Status of Domestic Waste Paper Recovery" can be given. Assessment considers whether the student's discussion reflects the impact of waste paper recovery on China's environmental development, particularly regarding Carbon Peak and Carbon Neutrality goals, examining their sense of responsibility and accountable behavior. This can be weighted 10%–20% of the grade.

In final tests, ideological-political elements should be naturally embedded as the "background," "objective," or "value orientation" of questions, rather than being isolated inquiries. Questions must be based on authentic, in-depth professional problems, with the ideological-political assessment implied in the problem-solving process and choices. Appropriately designed open-ended questions and case analyses provide space for students to demonstrate value judgments and engineering ethics considerations. The reasonableness, innovativeness, and sense of social responsibility of solutions should be explicitly included in the scoring criteria for comprehensive/design questions, with a suggested weight of 5%–10%. Evaluation should not only focus on results but also value the systems thinking, sense of responsibility, and engineering ethics considerations demonstrated in the analysis process. For open-ended questions, insightful, value-driven, and responsible responses should be encouraged; even if technical details are slightly lacking, recognition can be given in the "comprehensive literacy" component.

After assessment, an analysis of the achievement degree of course ideological-political objectives can be conducted through questionnaires, process assignments, and test papers. Improvement measures can then be proposed based on the findings, forming an ideological-political education closed loop of "design – implementation – evaluation – feedback – improvement" for continuous optimization.

4. Conclusion

Uncovering ideological-political elements and integrating them into the entire teaching process of the *Principles and Engineering of Papermaking* course is a systematic project requiring careful design and continuous improvement. By deeply exploring the value connotations within the course content and adopting scientifically sound integration strategies, the synergistic advancement of professional education and ideological-political education can be achieved. This integration not only enhances students' ideological and political literacy but also deepens their understanding of professional knowledge. It helps cultivate paper engineering talents who master advanced technology while possessing a strong sense of patriotism and dedication, providing solid talent support for the sustainable development of the industry and national ecological civilization construction.

In the future, further exploration is needed into the deep integration mechanism between ideological-political education and the construction of emerging engineering disciplines, and the development of more replicable and promotable teaching models for curriculum-based ideological-political education in engineering majors, contributing to the comprehensive implementation of the fundamental task of fostering virtue through education.

References

[1] Zhang Rong, Wen Jinyu, Li Hongbin, Yang Yong, He Hengxin. SystematicDesign and Implementation on Curriculum Ideological and Political Education Underground of Emerging Engineering Education. TRANSACTIONS OF CHINA ELECTROTECHNICAL SOCIETY .2023; 6: 3094-3100.

[2] Liu jie. Research on the Problems and Countermeasures Faced by the Curriculum Ideological and Political Education of the Engineering Programs. Journal of Anqing Normal University（Natural Science Edition. 2023; 29(2):115-119.

[3] Wang Chu, Li Xiaoyan, Lyu Zhigang, Di Ruohai, Dong Mianmian. Design and Implementation of Curriculum-based Ideological and Political Education in the Context of New Engineering Disciplines. University.2024; 21:146-149.