

Reform and Practice of Ideological and Moral Education Course in the "Electrical and Electronic Technology" Course

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Abstract: Aiming at the problems in the teaching of the course "Electrical and electronic technology" for non-electrical engineering majors, such as the disconnection between ideological and moral education and professional knowledge, insufficient student learning motivation, and lack of value guidance, this paper takes the construction of ideological and political education within the curriculum as an opportunity to carry out a systematic teaching reform exploration. By restructuring the "trinity" course objectives, systematically extracting the element system of five major ideological and political dimensions, developing typical case teaching materials, and innovating diversified teaching methods and assessment methods, the organic integration of knowledge imparting and value guidance has been achieved. Teaching practice shows that after the reform, the class attendance rate of pilot classes increased from 87.3% to 95.8%, the excellent rate of assignments increased from 72.5% to 84.6%, and students' satisfaction with the ideological and political education of the course reached 91.2%. This paper provides a referable practical path for the ideological and political construction of general technical basic courses for engineering majors.

Keywords: Ideological and Moral Education Course; Electrical and Electronic Technology; Teaching Reform; Element Extraction; Case Teaching

1. Introduction

In 2020, the Ministry of Education issued the "Guidelines for the construction of ideological and political education in higher education courses," which clearly states that the systematic promotion of ideological and political education within courses should focus on key areas such as political identity,

patriotism and family commitment, cultural literacy, awareness of the rule of law, and moral cultivation, integrating value shaping, knowledge imparting, and ability training into one [1]. Against this policy background, how to organically integrate ideological and moral education into science and engineering professional courses has become an important issue in the current reform of higher education [2]. "Electrical and Electronic Technology" [3] is a compulsory general education course offered to non-electrical engineering majors such as chemical engineering, bioengineering, and textile engineering. It has a total of 32 class hours, worth 2 credits, and benefits over 300 students annually. The course mainly teaches circuit basics, AC circuits, magnetic circuits and transformers, semiconductor devices, integrated operational amplifiers, digital logic circuits, etc., and undertakes the important tasks of cultivating students' circuit analysis ability, electronic technology application ability, and engineering literacy. However, the traditional teaching model has prominent problems of emphasizing knowledge transfer while neglecting value guidance, and the separation between ideological and moral education and professional teaching is very serious [4]. Students generally believe that electrical and electronic technology is unrelated to their own majors, resulting in significantly insufficient learning motivation. Additionally, the teaching cases are outdated, lacking effective cultivation of students' engineering ethics and scientific spirit. To this end, this course was approved as a university-level ideological and political education construction project in 2024, and taking this as an opportunity, a one-year teaching reform practice was carried out, aiming to explore a naturally integrated implementation path for ideological and political education within the course.

2. Current Situation and Problem Analysis

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and charts, must be kept within the parameters. Please do not write or print outside of the column parameters. Margins are 2.5cm on the left side, 2.5cm on the right, 3.0cm on the top, and 2.5cm on the bottom. Paper orientation in all pages should be in portrait style.

The target students of this course are second-year university students majoring in non-electrical engineering disciplines such as chemical engineering and technology, bioengineering, and textile engineering. These students have a relatively weak foundation in electromagnetism and exhibit obvious learning difficulties and resistance when it comes to circuit analysis. Their professional identity is strongly tied to their own majors, leading to a serious lack of recognition of the value of the electrical and electronic technology course. Furthermore, the class sizes are quite large, with combined classes typically ranging from 80 to 120 students, which makes classroom interaction difficult. In order to accurately understand the teaching situation before the reform, the project team conducted a systematic diagnosis through questionnaire surveys and classroom observations. A total of 120 questionnaires were distributed, with 112 valid responses collected. Combined with classroom observation records from three consecutive semesters, the project team summarized four major outstanding problems.

The first problem is the prominent phenomenon of forced integration of ideological and moral education. The survey showed that 76.8% of the students believed that the teacher's explanation of ideological and political content sounded like reading from a script, and 63.4% of the students indicated that the ideological and political content had little to do with the professional knowledge. Before the reform, teachers often added a segment of ideological and political content temporarily at the beginning or end of the class, such as simply saying "we must be patriotic" or "we must be dedicated," which lacked an inherent logical connection with the knowledge points, resulting in very low student identification.

The second problem is insufficient student learning motivation and low classroom participation. Classroom observation records from three consecutive semesters showed that the average attendance rate five minutes before class was only 87.3%. On average, fewer than three students per class actively asked or

answered questions. The rate of independent completion of after-class assignments was about 68%, with plagiarism being relatively common. In student symposiums, some students frankly stated that they were studying chemical engineering and would not need this circuit knowledge in the future. This mentality directly affected their learning outcomes.

The third problem is outdated teaching cases lacking a contemporary feel and appeal. The teaching cases used before the reform were mostly old cases accompanying the textbooks, such as analyzing household incandescent lamp circuits or calculating the lighting system of a certain factory building. These were far removed from the modern technologies familiar to contemporary students, such as chip technology, 5G mobile communication technology, and new energy sources, making it difficult to stimulate students' interest in learning.

The fourth problem is a monotonous assessment method lacking an educational orientation. Before the reform, the overall course grade consisted of two parts: regular grades, accounting for 30% (mainly based on assignment completion and attendance), and final exam grades, accounting for 70%. The regular grades only examined whether students submitted assignments or missed class, without any reflection on the evaluation of ideological and political literacy such as scientific spirit and engineering ethics. The existence of the above problems not only seriously affected the improvement of course teaching quality but also ran counter to the fundamental task of fostering virtue through education. At the same time, this course also possesses favorable conditions for carrying out ideological and political education reform: the course content itself contains rich ideological and political elements such as the spirit of scientists, engineering ethics, and patriotism; the course, being oriented towards multiple majors, has good universality and demonstrative value; and the project team has five teachers at or above the associate professor level and two senior experimentalists, with a reasonable team structure and a strong willingness to reform.

3. Reform Measures

The project team first redefined the course teaching objectives, establishing a trinity goal system integrating value shaping, knowledge

imparting, and ability training. In terms of knowledge objectives, students are required to master core knowledge such as basic circuit laws, AC circuit analysis methods, the working principles of semiconductor devices, and logic circuit design. In terms of ability objectives, students are expected to develop circuit analysis and calculation skills, basic electronic circuit design capabilities, and engineering problem-solving abilities. In terms of educational objectives, the aim is to cultivate five core qualities in students: scientific spirit, craftsmanship spirit, patriotism and family commitment, innovation consciousness, and professional ethics [5]. Specifically, the scientific spirit is embodied in a fact-based, rigorous, and truth-seeking attitude; the craftsmanship spirit is reflected in the pursuit of excellence and continuous improvement; patriotism and family commitment are expressed as national pride and a sense of mission to serve the country through science and technology; innovation consciousness is shown as the ability to break conventions and engage in integrated innovation; and professional ethics are demonstrated by prioritizing safety and adhering to standards. In terms of excavating ideological and political elements, the project team thoroughly reviewed the 32-hour teaching syllabus and systematically extracted the ideological and political elements embedded in each chapter following a five-step process: knowledge point, ideological dimension, ideological connotation, teaching case, and educational objective. Ultimately, a curriculum-based ideological and political education system centered on five major ideological dimensions was constructed. Specifically, in the module on basic circuit concepts, by comparing ideal wires with actual wires, students are guided to understand the applicability and limitations of models, thereby cultivating a fact-based spirit. Simultaneously, emphasizing that the reference direction of current and voltage is a human convention for analysis and calculation, much like social rules serve as the basis for efficient collaboration, helps develop students' rigorous, standardized, and truth-seeking scientific literacy. In the DC circuit analysis module, Kirchhoff's laws [6] embody the dialectical unity between parts and the whole in a system, while Thevenin's theorem [7] reflects the philosophical idea of simplifying complexity and grasping the

principal contradiction. These concepts help students establish a systems perspective and a holistic view. In the sinusoidal AC circuit module, the phasor method uses complex number operations to simplify sinusoidal analysis, serving as a model of using mathematical tools to solve engineering problems. The three-phase system, as the cornerstone of today's power grid, combined with China's world-leading achievements in ultra-high voltage transmission technology, effectively stimulates students' national pride and sense of mission to serve the country through science and technology. In the magnetic circuits and transformers module, iron losses and copper losses in magnetic circuits remind students to pursue high efficiency and low loss in engineering design, practicing the concept of green environmental protection. The characteristic of a transformer to change voltage and transfer energy without changing frequency can be likened to the qualities of dedication, duty, and selfless contribution. In the semiconductor devices module, by introducing semiconductors as the "grain" of the information industry and the bottleneck challenges China faces, combined with the struggle of companies like Huawei HiSilicon, students' patriotic enthusiasm, sense of crisis, and sense of responsibility are stimulated. In the integrated operational amplifier module, the concepts of virtual short and virtual break are idealized models, while actual op-amps have limitations, guiding students to understand the boundaries of theory. Negative feedback stabilizes the operating point of an amplifier circuit and can be likened to criticism and self-criticism, serving as an important mechanism for maintaining the healthy, stable, and continuous progress of a system or an individual. In the digital logic circuit module, the clear rules of AND, OR, and NOT operations in logic algebra cultivate rigorous logical thinking and a sense of rules. The progression from simple logic gates to a complex CPU demonstrates how complex systems are built from basic rules, encouraging original innovation. In the safe electricity use module, by emphasizing the mandatory nature of safety operation procedures and the need for accurate and truthful electrical measurements, students' awareness of safety, responsibility, and integrity is cultivated. In developing teaching cases, the project team

adhered to the principle of natural integration and avoidance of didacticism, developing three typical cases. The first case is the "China Story of Ultra-High Voltage Transmission," applied in the three-phase AC circuit module. When explaining the advantages and applications of three-phase electricity, the teacher plays a three-minute promotional video on the State Grid's UHV project, demonstrating how China's UHV technology solves the national challenge of energy resources being located in the west while demand is in the east. A three-to-five-minute group discussion is then organized, guiding students to reflect on the spirit of engineers embodied in this technology and how they, as future engineers, can contribute. This case effectively stimulates students' national pride and sense of mission to serve the country through science and technology. Students actively participate in the discussion, and after class, some take the initiative to consult relevant literature and mention in their assignments the need to overcome difficulties like UHV engineers. The second case is the "Chip War and Our Responsibility," applied in the integrated operational amplifier module. When introducing the history of integrated circuits, the teacher brings up the current international competition in the chip industry. Before class, students are asked to watch videos related to Huawei HiSilicon's "backup plan" becoming operational. In class, a five-minute discussion is organized around the theme "What can I do for China's chips?" The teacher concludes by emphasizing the importance of fundamental theoretical learning and original innovation. This case cultivates students' sense of crisis, sense of responsibility, and the spirit of perseverance in overcoming difficulties. Many students express in the discussion their desire to learn basic courses well and engage in core technology research and development in the future. The third case is "Safety First: The Bottom Line of Safe Electricity Use," applied in the safe electricity use module. When explaining safe electricity protection measures, the teacher presents news reports of two real electrical accidents, analyzes the causes and responsibility determinations, and emphasizes that any negligence can lead to irreversible losses. After class, students are assigned a reflective question requiring them to write three safety rules they must follow based on their own professional internship scenarios. This case

effectively shapes students' professional character of respecting life, obeying laws and regulations, and being rigorous and responsible. Subsequent laboratory sessions show a significant improvement in students' awareness of safety standards, with lab instructors reporting about a 40% reduction in safety violations compared to previous years.

In terms of teaching method innovation, the project team comprehensively applied analogical thinking pedagogy [8], project-based learning [9], and online-offline blended teaching [10]. Analogical thinking pedagogy compares abstract circuit principles with life philosophies and social rules to enhance the naturalness of ideological and political integration. Specifically, the reference direction of current and voltage is compared to social rules—it is a human convention, but adherence to it enables efficient collaboration. The stability adjustment of a negative feedback amplifier circuit is likened to criticism and self-criticism, serving as an important mechanism for healthy, stable, and continuous progress of a system or individual. The characteristic of a transistor controlling a large current with a small current is compared to a water tap valve, helping students understand the idea of using a small force to control a large force. Project-based learning is applied in the digital logic circuit module, where a simple voting device design project is implemented. Students go through the entire process of solving an engineering problem, from truth table derivation and logic expression simplification to logic gate selection, circuit connection, and debugging. During the project summary session, the teacher guides a discussion on integrated innovation thinking, from simple logic gates to complex systems. Online-offline blended teaching utilizes the Chaoxing Learning Platform. Before class, ideological and political materials such as short videos, news reports, and excerpts from scientist biographies are pushed to students. During class, online voting and bullet-screen discussions are organized. After class, extended reflection questions are released. Data shows that the pre-class reading completion rate for ideological and political materials on the platform exceeds 85%, and in-class interaction frequency has increased approximately twofold compared to before the reform.

In terms of assessment method reform, the

project team adjusted the composition of the overall course grade to 40% regular grades and 60% final exam grades. The regular grades are further broken down into assignments (15%), class participation (10%), and evaluation of ideological and political literacy (15%). The specific implementation of the ideological and political literacy evaluation includes three parts: first, adding reflective questions to regular assignments, such as asking students to describe the rigorous thinking steps they demonstrated in a circuit analysis, guiding them to self-examine their scientific spirit; second, including the quality of their contributions in ideological and political discussion sessions as part of class participation records; and third, setting one or two short-answer questions related to engineering ethics and social responsibility in the final exam paper, with this part accounting for approximately 5% to 8% of the total score.

4. Implementation Effect

The reform of this course began implementation in the pilot classes in the fall semester of 2024. The pilot classes included Materials Physics Class 1 and 2, Metallurgical Engineering Class 1 and 2, Mining Engineering Class 1 and 2, and Geological Engineering Class 1 and 2, totaling 154 students. The reform effects were compared and analyzed with those of the parallel classes from the fall semester of 2023 before the reform, which totaled 135 students. After one semester of teaching practice, students' learning behaviors showed significant improvement. The attendance rate 5 minutes before class increased from 87.3% before the reform to 95.8%, an increase of 8.5 percentage points. The average number of active class questions or answers per class rose from 2.7 to 7.4, more than doubling. The rate of independent assignment completion increased from 68.0% to 82.5%, an increase of 14.5 percentage points. The excellent assignment rate, defined as the proportion scoring 80 points or above, rose from 72.5% to 84.6%, an increase of 12.1 percentage points. The above data are derived from Learning Platform records, assignment grading records, and classroom observation records.

The effect of ideological and political education was equally remarkable. At the end of the semester, a questionnaire survey was distributed to the pilot classes, with 148 valid questionnaires returned, a response rate of 96.1%. The survey results showed that 91.2%

of the students believed that the ideological and political content was naturally integrated with professional knowledge without being abrupt; 87.8% of the students indicated that the course enhanced their pride in the country's scientific and technological achievements; 85.1% of the students agreed that the course content made them pay more attention to engineering ethics and safety standards; and 82.4% of the students reported an increased interest in learning electrical and electronic technology. In open-ended questions asking students which ideological and political element of the course touched them the most, high-frequency responses included ultra-high voltage transmission (47 occurrences), the chip war (39 occurrences), the safe electricity use case (28 occurrences), and negative feedback versus criticism and self-criticism (15 occurrences).

In terms of course evaluation scores, the student evaluation score for this course before the reform was 88.6 points, while the college average at that time was 89.2 points. After the reform, the evaluation score rose to 93.1 points, whereas the college average was 90.5 points. Among the dimensions, the scores for "teaching can inspire student thinking" and "teaching connects with practice and conveys positive energy" showed the most significant improvements, increasing by 5.2 points and 6.8 points, respectively. Furthermore, guided by the dimension of innovation consciousness in the ideological and political education, 7 students from the pilot classes signed up for the 2025 university-level Electronic Design Competition, with 2 groups winning third prizes, achieving a breakthrough for the non-electrical engineering majors targeted by this course in that competition.

5. Reflection and Outlook

Although the reform has achieved preliminary results, there are still some shortcomings in practice. Some ideological and political content appeared somewhat forced during the initial integration. For example, when explaining resistors in series and parallel, an abrupt connection was made to the idea that "unity is strength," and students reported that this connection felt rather strained. The project team subsequently adjusted its teaching strategy, weakening or eliminating such rigid associations and focusing on content that has a natural affinity with the knowledge points. The

evaluation tools for ideological and political education effects also need improvement. Currently, feedback relies mainly on questionnaire surveys and classroom observations, lacking pre-test and post-test scale tools, making it difficult to accurately measure students' specific changes in values. At the same time, the evaluation of ideological and political literacy is somewhat subjective, and the scoring criteria need further refinement. Furthermore, deep interaction under large class conditions is limited. Combined classes are usually large, typically ranging from 80 to 120 students, making it difficult for every student to fully express themselves during ideological and political discussion sessions, and some introverted students have lower participation rates.

To address the above problems, the project team will focus on the following tasks in the next stage. First, carefully refine 2 to 3 high-quality cases. Select the most effective cases from the current pool, such as ultra-high voltage transmission and the chip war, further enrich the materials by adding data charts and interviews with engineers, and form a standardized case teaching package for reference by other teachers in the department. Second, develop an assessment scale for the educational effects of ideological and political education within the course. Drawing on existing research on engineering students' engineering ethics awareness scales and scientific spirit attitude scales, and combining them with the characteristics of this course, develop pre-test and post-test assessment tools to be implemented in the next round of teaching, enabling quantitative evaluation of ideological and political education effects. Third, explore a hybrid model of online discussion plus offline reporting. To address the large class size issue, move some aspects of ideological and political theme discussions to the online Learning Platform discussion area, where students can post and exchange ideas first. In class, the teacher selects representative viewpoints for commentary and deepening, thereby expanding student participation. Fourth, strengthen teacher training. Organize project team teachers to participate in university-level or higher special training on ideological and political education within courses at least twice a year, regularly conduct collective lesson planning and case polishing, and continuously improve the

naturalness of ideological and political integration.

6. Conclusion

The ideological and political education reform of the Electrical and Electronic Technology course, guided by the goal of solving real teaching pain points, based on the systematic excavation of ideological and political elements, using typical case teaching as a lever, and supported by diversified evaluation, has initially achieved the synchronous resonance of knowledge imparting and value guidance. Practice has shown that ideological and political education within courses is not about addition but about multiplication; it is not about labeling but about deep integration. The more inherent connections there are between ideological and political elements and professional knowledge, the more natural and lasting the educational effect. The experience of this reform can be summarized into three key points: First, the focus is narrow, concentrating on specific problems of a specific course to avoid vague and general discussions. Second, the measures are concrete; each ideological and political case has a clear integration timing, implementation method, and educational objective. Third, the effects are clear, using comparative data to objectively present the reform results. This experience provides a referable and replicable practical path for the construction of ideological and political education within general technical basic courses for engineering majors under the context of emerging engineering education.

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