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# Research on the Integrated Implementation of Ideological and Political Education in Applied Electronic Information Courses Based on an Experiment-Driven Teaching Paradigm

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**Abstract: Against the backdrop of the ongoing construction of the "New Engineering Education" initiative, practical training courses for electronic information-related majors have become an important carrier for fulfilling the fundamental task of fostering virtue through education in the cultivation of application-oriented undergraduate talents. Aiming at the prominent problems existing in current engineering software practice courses, such as excessive emphasis on skill acquisition while neglecting value guidance, the separation between professional teaching and ideological and political education, and the difficulty in quantitatively evaluating the effectiveness of moral education, this paper takes the experiment-driven teaching mode as the core approach. Through the design of eight special MATLAB programming experiments, this paper explores the potential of ideological and political education integration in such courses. On this basis, by incorporating real industrial scene materials, this paper constructs a hierarchical and progressive ideological and political education system, which runs through the whole process from curriculum design to practical implementation of curriculum-integrated ideological and political education. Teaching practice shows that embedding ideological and political education content into experimental tasks can effectively weaken the indoctrination characteristics of traditional ideological and political education. While improving students' programming ability and digital simulation level, this method can promote the collaborative improvement of students' engineering literacy, inquiry spirit and national responsibility consciousness, and then construct a replicable and popularizable implementation path for curriculum-integrated ideological and political education.**

**Keywords: Applied Electronic Information; Signal Processing Auxiliary Software; Experiment-Driven Approach; Curriculum-Integrated Ideological and Political Education**

## 1. Introduction

With the continuous advancement of the New Engineering Education Initiative and the implementation of the *Guidelines for Integrating Ideological and Political Education into University Curricula*, engineering education in Chinese institutions of higher education has shifted away from the singular orientation of knowledge impartation, and now targets the synergistic realization of the three-dimensional educational objective integrating knowledge acquisition, capability improvement and value guidance [1,2]. For local application-oriented undergraduate institutions, the training of electronic information-related majors is centered on the orientation of matching regional industrial development demands, hence practical training courses occupy a relatively high proportion in the overall talent training system. Taking the 2012 cohort of Electronic Information Engineering major at a specific application-oriented undergraduate university as an example, the total practical teaching hours account for 40% of the total teaching hours specified in the talent training program, corresponding to 24% of the total credits. Meanwhile, such institutions have adopted a variety of practical teaching modes such as the university-industry collaborative education framework of "Five Platforms and One File", the "combination of theory and practice" mode and the "imitation-based" teaching mode, aiming to position practical training links as the core

carrier for cultivating engineering literacy and professional character. The *Signal Processing Auxiliary Software* course studied in this paper has a total of 30 class hours, and does not set up independent theoretical teaching sessions; all teaching content is decomposed into 8 thematic MATLAB programming experiments. This course is a tool-based connecting link between core professional courses, and acts as a foundational support for students' follow-up professional learning.

In the traditional teaching mode, the teaching focus of this course has long been concentrated on the practical training of MATLAB operation skills, and the evaluation criteria only focus on program operation results and the standardization of experimental report formatting, leaving a prominent gap in the cultivation of students' comprehensive professional ability [3]. At present, the ideological and political education content of this course only adopts the mode of adding a general introduction lecture at the course launching stage, which lacks combined practical scenarios and is separated from the core professional curriculum. It is difficult to realize the cultivation of students' value identification. Moreover, there is a lack of targeted ideological and political guidance programs and matching evaluation systems for moral education, making it impossible to quantitatively measure the effectiveness of ideological and political education. Against this background, exploring an adaptive ideological and political education implementation path for this course with the attribute of full experimental teaching has become an inevitable requirement for improving the teaching quality of the course and completing the fundamental task of fostering virtue through education.

Among the existing research results, international engineering education mostly integrates engineering ethics and industrial norms into project-based learning activities. For example, American scholars have proposed integrating the "service-learning" mode into the curriculum, and more than 80% of American universities have carried out service-learning projects. This mode combines knowledge impartation and value guidance by organizing students to participate in community service projects, focusing on cultivating students' professional responsibility consciousness. In addition, institutions such as the Massachusetts Institute of Technology have introduced the CDIO engineering education mode, which takes the whole life cycle from product research and development to operation as the carrier, and guides students to learn engineering knowledge through active practice. However, on the whole, international engineering education has not yet formed a systematic and complete ideological and political education system. The domestic academic circle has carried out extensive exploration on the integration of ideological and political education into engineering courses; for example, relevant ideological and political teaching cases have been formed in theoretical courses such as "MATLAB and Computing Methods". Nevertheless, existing research is mostly concentrated in the fields of theoretical courses and comprehensive project courses, and targeted research for pure computer-based MATLAB software practice courses is still relatively scarce [4]. Moreover, most of the existing teaching reforms face problems such as unclear ideological and political integration framework, single implementation path and imperfect evaluation system, which are difficult to adapt to the teaching context of practical training courses in applied undergraduate colleges [5]. Based on the above research status, this study adopts action research, case study, questionnaire survey and other research methods, carries out the reform through two semesters of iterative teaching practice, taps into the teaching pain points existing in the original curriculum, constructs an integrated ideological and political education reform framework with experimental driving as the core, selects two core experimental cases to display the implementation of teaching practice, and builds a two-way evaluation mechanism integrating ability improvement and literacy cultivation. This study evaluates the effectiveness of the reform through data analysis and summarizes the direction of follow-up improvement, which provides a referenceable practical framework for the optimization of ideological and political education in similar courses.

## 2. Relevant Concepts and Theoretical Framework

Electronic information-related majors offered by local application-oriented undergraduate institutions differ significantly from those at research-intensive universities: their core educational goal is to cultivate frontline

engineering and technical talents that serve local industries. The curriculum system and teaching design prioritize practicality and hands-on application, requiring that all knowledge points be ultimately implemented in practical engineering scenarios. The experiment-driven teaching model takes independent experimental projects as the basic teaching unit, and integrates knowledge explanation, skill cultivation and value guidance into hands-on practical activities. This teaching method aligns with the teaching logic of engineering practical training courses and can effectively stimulate students' active critical thinking. The "trinity" integrated education framework that integrates professional course teaching, ideological and political education and character cultivation clarifies the educational logic of this type of course, and requires that professional knowledge acquisition, practical skill improvement and value concept shaping be promoted synchronously, which solves the long-standing problem of separation between professional teaching and moral education in traditional courses.

Existing practical cases have verified the effectiveness of this framework: a certain university has systematically integrated educational resources and forces in all fields of school governance, all teaching links and the whole process of talent cultivation, and has achieved full coverage of curriculum ideological and political education in 40 undergraduate majors of 13 teaching colleges, with remarkable educational results [6]; higher vocational colleges have carried out the reform of the "trinity" teaching structure of ideological and political courses. Through the three progressive links of theoretical knowledge teaching, course hot spot analysis and practical teaching experience, it highlights the advantages of all-round education, cultural education and cooperative education, and effectively improves the effectiveness of ideological and political education [1]; other colleges and universities have explored the "course + competition + ideology and politics" integrated education model. Under this model, students have won more than 10 awards at or above the provincial level in the past two years, and their identity has gradually transformed from "professional knowledge learners" to "social problem explorers", and the quality of talent cultivation has been continuously improved [7-8].

This curriculum reform is supported by three core educational theories: The fundamental task of fostering virtue through education in higher education clarifies that all courses should assume the function of moral education, puts forward the requirement of building a "Three-Aspect Comprehensive Education" pattern, and provides a solid theoretical foundation for the integration of ideological and political education into practical training courses; Implicit education theory advocates getting rid of rigid indoctrination, and uses tasks, cases and real scenarios to imperceptibly transmit value concepts, which can effectively reduce students' rejection of ideological and political education; The "Learning by Doing" theory emphasizes that practice is the core carrier of cognitive construction and character formation. In the process of continuous trial and error in practice, students can naturally develop a rigorous, pragmatic and persistent professional character, which provides a practical logic basis for carrying out experimental ideological and political education [9-10].

## 3. Current Status of Course Teaching and Challenges in Implementing Ideological and Political Education

The *Signal Processing Auxiliary Software* course is offered to third-year undergraduate students majoring in Electronic Information Engineering, with a total of 30 credit hours, all of which are allocated to computer-based practical teaching. The course is organized into 8 progressively ordered MATLAB experiments, covering teaching modules including basic matrix operations, programming, drawing and numerical calculation. In the original teaching system, only the cultivation of students' tool application ability was taken as the core goal, and the goal of value shaping was not clearly defined. Long-term teaching practice has gradually exposed multiple shortcomings of the original course model:

First, there exists a structural imbalance in educational objectives. Existing teaching evaluation overemphasizes the correctness of program operation results, while ignoring the cultivation of students' abilities in the process of practical learning; at the same time, for problematic behaviors such as simplifying boundary detection logic, plagiarizing program codes and falsifying original experimental data, there is a lack of systematic normative constraints and guidance on the cultivation of

programming norms and academic literacy. Second, the integration path of curriculum ideological and political education is single, and there is an obvious disconnection between professional teaching content and the requirements of moral education. At present, only general ideological and political indoctrination is carried out at the course introduction stage, and no corresponding industrial cases are introduced in combination with specific practical scenarios such as matrix operation, program fault tolerance and algorithm debugging, which makes it difficult for students to establish the logical connection between professional practice and engineering responsibility [11]. Third, the design of curriculum ideological and political education lacks hierarchical pertinence. All experiments adopt unified generalized teaching materials, and ideological and political content is not designed according to the specific practical characteristics of each experiment, leading to the superficialization of value guidance. Fourth, the existing curriculum assessment system lacks the dimension of ideological and political inspection. The original course score consists of three parts: homework, experimental report and comprehensive design project, and no quantitative evaluation index is set for rule awareness, exploration spirit, innovative thinking and patriotic sentiment, so the actual effect of curriculum ideological and political integration cannot be objectively measured [12]. From the perspective of the inherent teaching characteristics of the course, the fully experimental practical training teaching mode provides a naturally suitable carrying platform for the development of curriculum ideological and political education. The course has 8 clear experimental modules from basic matrix operation to comprehensive numerical simulation, and different modules have great differences in practical difficulties and training focuses, which can correspond to different levels of curriculum ideological and political elements such as rigorous pragmatism, adherence to rules and ethics, overcoming difficulties, independent innovation, and serving the country with science and technology [13]. The process of programming and debugging itself includes multiple links of trial and error, error correction and optimization. Therefore, teachers can observe students' behavior in real time in the process of guided participation, and carry out targeted guidance when students show perfunctory coping, evasion of difficulties, academic misconduct (plagiarism, etc.). Real industrial cases such as industrial control system fault diagnosis and domestic software research and development can be directly embedded in experimental tasks, so that students can understand the responsibilities and missions of engineering roles intuitively while completing programming problems, and realize the organic integration of professional ability cultivation and value guidance [14]. The School of Electrical Engineering and New Energy of China Three Gorges University has also explored and integrated ideological and political elements by relying on the characteristics of the single-chip microcomputer course, and combined it with engineering ethics education, which provides a practical reference for the development of ideological and political education in professional courses.

## 4. Design of an Integrated Curriculum-Driven Ideological and Political Education Reform Plan

This teaching reform has constructed a complete education system featured by "one experimental platform, three levels of educational objectives, four stages of implementation paths and two integrated evaluation systems". Taking 8 practical teaching experiments based on MATLAB as the core carrier of curriculum ideological and political construction, this reform redefines the three-dimensional curriculum objectives of knowledge, ability and value, and designs an integrated implementation process covering pre-class preparation, classroom lecture, laboratory practice and post-class reflection. At the same time, a comprehensive evaluation mechanism that balances professional ability and ideological and political literacy has been constructed, forming a complete closed-loop implementation chain of curriculum ideological and political education.

Under the reconstructed curriculum objective system, in the knowledge dimension, students are required to master the core tool knowledge proficiently, including MATLAB matrix operation, branch and loop syntax, function encapsulation, visual drawing and numerical calculation, and understand the development status of China's domestic simulation software industry. According to the data of *China Industrial Software Development White Paper*

released in the first quarter of 2025, the market size of China's domestic system-level simulation software has exceeded 12 billion yuan, with a compound annual growth rate of 18.6%; according to the data of China Research and Development Institute for Industry, the market size of China's computer simulation industry exceeded 220 billion yuan in 2022, but the localization rate of CAE software is only 5%; the *China Industrial Software Market Research Report* shows that in 2022, the market size of China's industrial software was about 230 billion yuan, with a year-on-year increase of 15.7%, and it is expected to reach about 360 billion yuan in 2025. In the ability dimension, it focuses on cultivating students' practical ability to independently write, debug and optimize M files, so that students can use MATLAB to complete complex mathematical calculation and digital system simulation analysis in the field of electronic information. In the value dimension, combined with the different teaching objectives of 8 experiments, differentiated value guidance is carried out: the matrix processing experiment cultivates the scientific spirit of respecting original data and being rigorous and pragmatic; the selection structure experiment focuses on cultivating the awareness of abiding by engineering standards, safety norms and rules; the loop structure experiment focuses on cultivating the perseverance and problem-solving thinking; the function design experiment guides students to establish modular thinking and team spirit; the advanced drawing experiment cultivates the craftsman spirit of striving for excellence; the underlying drawing experiment encourages innovative thinking of exploring the principle and breaking through; the linear algebra calculation experiment cultivates the scientific thinking of objective, dialectical and rational analysis; the numerical fitting experiment, based on the needs of engineering applications, cultivates the strong awareness of applying what one has learned and being independent and self-reliant [15].

Based on the course teaching process, this study designs a four-stage full-chain implementation path of curriculum ideological and political education: In the pre-class preparation stage, the online learning platform is used to push industry-related ideological and political expansion materials, such as the sudden failure case of industrial control equipment of He* (Suzhou) Special Materials Co., Ltd., and the practical case of Shanghai Second Polytechnic University building a localized industrial control simulation experiment environment, and set up preparatory reflection questions to guide students to establish the cognitive connection between professional operation and engineering responsibility. In the classroom teaching stage, ideological and political cases are analyzed simultaneously with experimental knowledge points, and group discussions are organized to integrate programming norms, engineering safety requirements and the strategic significance of independent research and development into knowledge teaching. In the computer experiment stage, when students have problems such as missing fault-tolerant code, avoiding debugging tasks, and mechanically plagiarizing others' code, the teachers give timely and targeted guidance to help students establish correct behavior habits in practice. In the post-class summary stage, the "ideological and political perception" section is set in the experimental report, requiring students to write their learning insights in combination with the experimental supporting cases, so as to internalize the perceptual experience in the practice process into stable value cognition.

## 5. Typical Implementation Cases of Integrating Ideological and Political Education into Curriculum Teaching

### 5.1 Selection Structure Programming Experiment: Cultivating Rule Awareness and Engineering Bottom-Line Thinking

This experiment consists of a 4-hour hands-on practical session in a computer laboratory. Its core instructional objective is to demonstrate the implementation of grade classification based on a 100-point marking system through branch statements, and to incorporate input validity checking code, so as to cultivate students' ability to construct multi-branch logical structures and implement program fault tolerance. The ideological and political education module of this experiment introduces a typical case of equipment failure in an industrial signal detection system: a developer omitted a range-checking branch, which directly caused equipment damage when an out-of-range signal was input, resulting in economic losses and delayed project delivery. The root cause of the accident was that the developer ignored mandatory development specifications and

arbitrarily removed safety verification logic.

The ideological and political education content of this experiment runs through the whole teaching process from pre-class to post-class. Before class, accident-related materials and pre-class reflective questions are released to students. In class, in-depth analysis of the case corresponding to the experimental task is carried out, and students are organized to carry out themed discussions focusing on engineers' professional norms and safety boundaries. In the hands-on practice session, instructors focus on checking the implementation of fault-tolerant code, and provide targeted case-based guidance for students who arbitrarily simplify the program. After class, students are required to discuss the value of fault-tolerant design for constructing engineering safety boundaries in their experimental reports. After the implementation of this teaching mode, most students take the initiative to improve the exception handling code and clearly annotate the security verification functions, and students' rule awareness and bottom-line thinking have been significantly enhanced.

### 5.2 Circular Structure Programming Experiment: Cultivating a Spirit of Perseverance and Overcoming Challenges

This experiment is arranged across four class hours, requiring students to adopt two different methods to identify three-digit narcissistic numbers and conduct comparative analysis on the operating efficiency of the two methods, so as to help students master cyclic iteration logic and efficient programming technologies. In the debugging process of cyclic structure codes, students have a relatively high probability of encountering errors. Frequent exposure to compilation errors can easily induce fear of difficulty and weaken students' willingness for independent exploration. To address the above teaching problems, this course introduces the independent research and development process of a domestic scientific computing simulation software package as ideological and political teaching content. For a long time, China has been dependent on foreign commercial software in this field, and there are potential "neck" constraints on core technologies. After thousands of algorithm iterations and tens of thousands of debugging and optimization by domestic scientific research teams, the core modules have finally realized independent control.

The specific teaching design of this course is arranged as follows: In the pre-class preparation stage, students are provided with relevant research and development documents to help them pre-understand the difficulties in the research and development process; In the hands-on practice stage, the above research and development case is introduced for students who have the idea of giving up. Through analogy, students are guided to realize that technological breakthroughs require continuous trial and error, and students are encouraged to independently find and solve code problems, and teachers do not provide complete executable codes; After class, students are required to record the whole problem-solving process and write a reflection paper combined with the research and development case. Teaching practice shows that after the implementation of this teaching reform, the proportion of students taking the initiative to independently troubleshoot problems has increased significantly, the phenomenon of students evading difficulties has been significantly reduced, and students' identity with China's independent innovation strategy has been continuously enhanced.

## 6. Comprehensive Evaluation Mechanism for the Dual Integration of Professional Education and Moral Education

This reform abandons the traditional single-skill-oriented assessment paradigm and constructs a diversified evaluation system that prioritizes formative assessment and integrates both quantitative and qualitative evaluation methods. Professional competence and ideological-political literacy are incorporated into the overall scoring framework, forming a closed-loop education mechanism that enables the effectiveness of education to be observable and measurable.

This assessment system consists of two core evaluation dimensions: The professional competence dimension, which accounts for 70% of the total score, includes four components: code quality, original experimental process records, professional analysis of experimental reports, and comprehensive design documents. This dimension focuses on evaluating the functional completeness of code, algorithm optimization schemes, and the authenticity of experimental data recording. The ideological-political literacy observation dimension,

accounting for 30% of the total score, comprehensively evaluates students' compliance with coding standards, security verification awareness, attitude toward overcoming debugging difficulties, academic integrity in processing experimental data, active participation in classroom discussion, and the depth of ideological-political reflection, so as to realize dynamic tracking of students' behavior throughout the practical training process.

The overall course score is structured as follows: program code quality (40%), original experimental process record (20%), classroom practice performance (15%), and comprehensive experimental report (including ideological-political reflection part) (25%). In the code evaluation stage, significant score deduction is implemented for programs that intentionally omit fault-tolerant logic, have non-standard formatting, or lack standardized comments. In the practical performance evaluation stage, focus is placed on observing whether students independently identify code vulnerabilities, as well as whether there is academic misconduct such as plagiarism and data falsification. The ideological-political reflection part is scored based on the depth of students' thinking and their understanding of professional responsibility. At the end of each semester, the course integrates assessment data and questionnaire results to identify links that need to be strengthened in the integration of ideological and political education, and adjusts the teaching content for the next semester to achieve continuous optimization of teaching design.

## 7. Outcomes and Current Limitations of Teaching Reform Implementation

After two semesters of teaching practice, this teaching reform has achieved multi-dimensional results: At the level of professional competence, the achievement rate of course objectives has been significantly improved; students' awareness of coding standardization, program robustness and algorithm optimization has been significantly enhanced; the vast majority of students can take the initiative to add verification logic or optimize computing efficiency, and the quality of simulation assignments in subsequent professional courses has also been improved simultaneously. Existing studies show that the improvement of course objective achievement has a significant positive impact on teaching effect; according to relevant surveys, more than 80% of teachers believe that evaluating course objective achievement can effectively improve teaching results, and when students have a clear grasp of course objectives, learning efficiency can be increased by about 30%. At the level of ideological-political literacy, academic misconduct such as data falsification and plagiarism in course assignments has been basically curbed; students are more willing to carry out independent debugging and in-depth exploration, and their understanding of the contemporary demand for industrial self-reliance and technological self-improvement has been deepened. The survey results show that 92% of respondents accept the integration of ideological and political education into experimental cases, and 87% of students have established a rigorous and standardized professional engineering thinking through this practical training, so the reform has been widely recognized by students.

Nevertheless, this reform still has three limitations: First, the content stock of the existing industry-specific ideological and political education case base is insufficient, and the supply of case materials matching local industrial characteristics is insufficient. Second, the current experimental design is dominated by single-person independent programming tasks, and there is a lack of group cooperation projects and corresponding platforms for cultivating team cooperation awareness. Third, the evaluation of ideological-political literacy is still mainly based on qualitative description, the quantitative and detailed evaluation criteria need to be improved, and the objectivity of the evaluation process needs to be further enhanced.

## 8. Research Findings and Optimization Pathways

### 8.1 Research Findings

Adopting an experiment-driven approach to integrate ideological and political education into professional curricula can effectively address the widespread problem of disconnection between professional teaching and ideological-political education in pure software practical training courses. The practical exploration of integrating ideological and political education into microcontroller training courses in vocational colleges confirms that this model possesses significant reference value for the reform of practical training courses. By embedding real industrial cases into MATLAB hands-on

practice tasks, the natural integration of knowledge impartation and value guidance is achieved, which avoids the common resistance of students to abstract and hollow indoctrination. By setting differentiated ideological-political dimensions for different experimental modules and adopting a hierarchical education strategy, this approach accurately aligns with the characteristics of practical training courses and promotes the gradual improvement of students' engineering literacy. The construction of an evaluation system that integrates professional competence and moral education can quantify and objectify teaching effects, form a complete closed loop of teaching feedback, and effectively implement the fundamental task of fostering virtue through education.

### 8.2 Continuous Optimization Measures

Subsequent teaching practice will be optimized from three dimensions: first, expand the localized ideological and political education case base by supplementing new teaching materials related to independent research and development and engineering safety; second, design comprehensive group-based design tasks to cultivate students' team collaboration ability through collaborative programming practice; third, improve the quantitative scoring criteria for ideological and political literacy to enhance the objectivity and fairness of the evaluation system.

### 8.3 Research Outlook

The experiment-driven curriculum ideological and political reform model proposed in this paper has strong generalizability and can be replicated and applied to similar engineering practice courses; the practical education system constructed in this study can provide reference for curriculum reform in similar disciplines. Future teaching practice will further deepen the integration of industry and education: based on the practical experience of the School of Information Science, Qiqihar Institute of Technology, practical engineering projects from local electronic information enterprises will be introduced as experimental teaching tasks, so as to construct a teaching model characterized by "real scenario, authentic learning, hands-on operation, and practical skill acquisition". Based on the teaching practice of the Microelectronics major at Jiangsu Institute of Information Technology, the integration path of engineering projects and professional curricula will be optimized. The coverage of curriculum ideological and political education will be expanded by supplementing the career development stories of enterprise engineers; by drawing on the successful experience of integrating the concept of the National Undergraduate Electronic Design Competition into practical teaching, the integrated education system for applied electronic information engineering practical courses will be improved, so as to cultivate new-era engineering and technical talents with solid engineering practice ability, sound professional ethics and strong national responsibility.

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