



# Exploration and Practice of Ideological and Political Education Model in the “Digital Electronic Technology” Course under the Context of Engineering Education Accreditation

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**How to cite this paper:** Wu, D. (2026) Exploration and Practice of Ideological and Political Education Model in the “Digital Electronic Technology” Course under the Context of Engineering Education Accreditation. *Open Access Library Journal*, **13**: e15300.  
<https://doi.org/10.4236/oalib.1115300>

**Received:** April 4, 2026

**Accepted:** June 19, 2026

**Published:** June 22, 2026

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## Abstract

Engineering education accreditation puts forward dual requirements of “fostering virtue through education” and outcome-based ability cultivation for engineering talents, and how to realize the deep integration of ideological and political education and professional ability cultivation in core engineering courses is a core problem facing the teaching reform of local engineering colleges and universities. Taking this problem as the core research objective, this study promotes curriculum reform under the guidance of the “Two Qualities and One Degree” (High-Level Order, Innovation and Challenge Degree) golden course construction standard, based on the existing two rounds of blended teaching reform achievements of the “Digital Electronic Technology” course in our university. Guided by the achievement requirements of engineering education accreditation, this study clarifies the course’s ideological and political education objectives, reconstructs and optimizes the curriculum teaching system, explores the integration of ideological and political elements into the whole teaching process, and finally constructs the “5 + 5 + 3” (This reform relies on five ideological and political education platforms, including the smart theoretical classroom, the virtual-real integrated innovative experiment platform, the academic competition platform, the “factory on campus” practice platform, and the course MOOC platform. It fully excavates ideological and political elements of five themes: patriotism, professional ethics, teamwork, innovative spirit, and craftsman spirit, deeply integrates these elements into the whole chain of education and teaching, and promotes the three-in-one integration of “knowledge impartment, ability cultivation and value shaping”) curriculum ideological and political education framework, a three-level progressive innovative practical

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ability cultivation system integrating information technology, and a data-driven whole-process evaluation system for the effectiveness of curriculum ideological and political education based on the OBE concept.

### Subject Areas

Educational Reform

### Keywords

Engineering Education Accreditation, Digital Electronics Technology Program, Civics, Parenting Model

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## 1. Introduction

The Implementation Plan for the Excellence in Engineering Education and Training Program 2.0 continuously advances the development of new engineering disciplines, radiates the effects of engineering education certification reforms, and accelerates the cultivation of outstanding engineering and technological talents capable of adapting to and leading the demands of the new era. The essence of new engineering disciplines is guided by the principle of fostering virtue through education, with the construction philosophy of addressing changes and shaping the future. It primarily employs inheritance and innovation, interdisciplinary integration, coordination, and sharing as key approaches to cultivate versatile and innovative outstanding engineering talents, characterized by strategic orientation, innovation, systematic design, and openness [1]-[3]. The goal of higher education is to nurture well-rounded individuals with balanced moral, intellectual, physical, aesthetic, and labor education. By fully leveraging the classroom as a channel for nurturing, it integrates the analysis of ideological and political perspectives, helping students establish correct learning, life, and value outlooks, thereby comprehensively enhancing their overall competencies [4]-[6].

Under the background of engineering education accreditation and the objectives of national-level first-class course construction, this study is based on the BOPPOS teaching model and MOOC platforms. It addresses issues arising during the implementation of ideological and political education in curriculum reform, using Guilin University of Technology's "Digital Electronic Technology" course as a pilot for ideological and political education. Guided by the requirements of engineering education accreditation and the standards for "excellent courses" (the "Two Qualities and One Degree" criteria), the study clarifies student moral education goals, expands learning opportunities, and optimizes the teaching system of "Digital Electronic Technology". Leveraging existing hybrid teaching reform achievements in "Digital Electronic Technology," it deeply integrates ideological and political elements throughout the entire teaching process, establishing a "5 + 5 + 3" ideological and political education system for "Digital Electronic Technol-

ogy”. Additionally, it constructs a “three-stage progressive” innovative practical ability cultivation system deeply integrated with information technology and an outcome-driven, process-oriented, continuous evaluation system for ideological and political education effectiveness based on OBE principles. By addressing these key issues, the study advances research in the ideological and political spheres.

## 2. Current Status of the “Digital Electronic Technology” Course

“Digital Electronic Technology” is a fundamental course in a major, and there is a common situation of combined class teaching, which often results in a teaching class with at least 60 students. The teaching reform was fully rolled out in 6 classes across 3 academic years (from the fall semester of 2022 to the spring semester of 2025). It is mainly aimed at the automation major. Due to the lack of efficient and convenient teacher-student interaction tools, the teaching effect of large class teaching is not satisfactory. And there are several problems and reasons for the ideological and political education teaching in the course of “Digital Electronic Technology”: 1) There is a lack of understanding of the importance of integrating ideological and political education into professional courses (reason: teachers only focus on “skills” and ignore morality); 2) Unclear educational goals (reason: traditional teaching methods); 3) The disconnect between theory and practice has resulted in the absence of a distinctive teaching model, making it difficult for ideological and political elements to be deeply integrated into the curriculum teaching process, and failing to effectively enhance students’ comprehensive qualities and abilities (due to improper ideological and political teaching methods, and the “two skins” of curriculum education and ideological and political education); 4) The number of “bow down tribe” has increased, lacking interactivity (reason: strong theoretical basis). 5) The form of course assessment and evaluation is single, especially the evaluation of ideological and political elements in the course is difficult (reason: the evaluation criteria for ideological and political elements are not clear). Therefore, how to deeply integrate ideological and political elements into curriculum teaching and enhance students’ comprehensive abilities and literacy is a practical problem faced by teachers of the “Digital Electronic Technology” course. Under the requirements of engineering education accreditation, the ideological and political objectives of this course are precisely aligned with the above requirements: the cultivation of patriotism and national pride is connected to the “social responsibility” requirement of engineering accreditation; the cultivation of scientific spirit and rigorous attitude is matched with the “problem analysis and engineering design” ability objectives of the course; the cultivation of craftsman spirit and innovation consciousness corresponds to the requirement of “lifelong learning and innovation ability” in engineering education.

In summary, in order to scientifically and effectively get rid of the phenomenon of “two skins” in curriculum education and ideological and political education, promote the deep integration of curriculum ideological and political education

with professional skills training, achieve the goal of curriculum ideological and political education, build a multi subject interactive, heuristic, and exploratory classroom, establish a collaborative education model of teaching, research, and innovation integration, build an innovative practical ability cultivation system that deeply integrates information technology, create a data-driven process oriented and sustainable evaluation system for the effectiveness of curriculum ideological and political education, and effectively help students grow and succeed. Therefore, it is imperative to reform the ideological and political education model of the “Digital Electronic Technology” professional course.

### **3. Reform Measures for Blended Teaching in the Course of “Digital Electronic Technology”**

**1) Guided by the certification standards for engineering education, establish a collaborative education model that integrates ideology, politics, research, and creativity in the “5 + 5 + 3” curriculum of “Digital Electronic Technology”.**

a) Based on five major ideological and political platforms, including the Smart Theory Classroom, the Virtual Reality Integration Innovation Experiment Platform, the Discipline Competition Platform, the “Campus Factory” Practice Platform, and the MOOC Course Platform, we fully explore the “curriculum ideological and political” elements of the five themes of “patriotism + professional ethics + teamwork + innovation spirit + craftsmanship spirit”, deeply integrate them into the entire education and teaching chain, promote the integration of “knowledge imparting + ability cultivation + value shaping”, and construct the “5 + 5 + 3” curriculum ideological and political collaborative education model. Change the traditional mode of writing course objectives, write course ideological and political teaching outlines and lesson plans, and incorporate ideological and political elements in various ways in a timely and appropriate manner. b) Enrich educational resources and ideological and political programs. Taking the cultivation of innovation ability as the main line, it greatly stimulates students’ endogenous learning motivation, constructs a new system of information-based teaching resources based on the five core elements of “MOOC video + MOOC question bank + smart courseware + virtual simulation experiment cases + MOOC micro exercises”, and realizes the transformation of learning mode from one-dimensional passive learning in space to multi-dimensional virtual real space integration of fragmented and interactive self-directed learning. The course relies on the MOOC discussion platform to publish excellent deeds, inspirational stories of senior students, and videos of competition works, and enhances students’ professional identity through the use of a role model teaching method. At the same time, before the course is taught, it is pushed to the student’s end through the Rain Classroom platform. Students can learn about exemplary stories through pre-class preparation, enhance their interest in learning the knowledge points of this section, and organically integrate the stories and knowledge points to stimulate their national pride and patriotism. In class, students are given knowledge point reviews and mastery test questions,

and are required to write down the solving process and explain the solving ideas. Other students are asked to comment and find corresponding errors, which stimulates students' hands-on ability and cultivates their dialectical thinking ability. After class, actual engineering cases will be distributed to students. Firstly, the Multisim software virtual simulation platform will be used to simulate circuit design for students. At the same time, Proteus software will be used to create plate-making software. The "Pocket Lab" devices distributed to each student will be grouped to complete the physical production of engineering practice cases, forming a full chain of "virtual simulation + plate making design + physical production" to cultivate students' ability to solve engineering practice problems. By showcasing the personal charm of teachers in the classroom, showcasing their excellent qualities of dedication, caring for students, diligent research, rigorous learning, and striving for progress, they subtly influence students' socialist core values. c) Using smart courseware to select suitable project teaching cases, creating virtual simulation animation videos based on each chapter's knowledge points, cultivating students' ability to understand engineering practice problems in a simple and understandable way, continuously promoting the reform of project-based teaching, and forming practice cases with professional characteristics. Furthermore, the integrated teaching method is adopted to incorporate project cases and role model stories into the educational reform approach. d) With the help of the National Electronic Technology Foundation Virtual Teaching and Research Office platform at Tsinghua University, we will complete teacher training, share, and exchange teaching reform methods. Through online and offline meetings, we will target teaching pain points, discuss solutions, and apply good teaching methods to the process of teaching reform practice. Based on the BOPPOS (Behavior, Objective, Pretest, Participation, Practice and Summary) teaching model and MOOC platform, guided by the "Golden Course" construction standards, we optimize and reconstruct the ideological and political mixed teaching system of the "Digital Electronic Technology" course, and construct a new teaching model that integrates "teaching, learning, testing, imitation, testing, politics, evaluation". We aim to create a deep, difficult, and challenging classroom, highlighting the teacher's leadership and the student's main position, and designing a full chain teaching process before, during, and after class.

**2) Build a "three-level progressive" (three-level progressive practice system consisting of basic application-oriented practice system, comprehensive advanced practice system, and compound innovation-oriented practice system) innovation practice capability cultivation system that deeply integrates digital information technology**

a) Based on digital information technology, build a "three-level progressive" innovation practice ability cultivation system. This includes a basic application-oriented practical system based on "basic verification, comprehensive design, and engineering innovation experiments", a comprehensive high-level practical system based on "electronic circuit skills internship + electronic circuit discipline competition", and a composite innovative practical system based on "scientific

research projects + real projects in schools and factories”. The basic application-oriented practical system is mainly aimed at cultivating students’ basic practical abilities, enabling them to consciously, purposefully, and systematically develop hands-on skills in the early stages; The comprehensive high-level practical system is mainly aimed at cultivating students’ high-level abilities, learning to analyze and solve experimental results, and effectively applying theoretical knowledge to the practical process; The composite innovative practice system is mainly aimed at cultivating students’ innovative thinking, not limited to practical experience in books, but should be connected to enterprises and achieve real problems and actions.

b) Design a reverse “3 + 3” experimental teaching plan guided by teacher-led, student-centered, and innovation-oriented experimental teaching objectives, which includes engineering application requirements, comprehensive ability cultivation, and basic knowledge reserve. Targeted knowledge transmission and experimental plan reform will be carried out. The three types of experiments, namely basic application, comprehensive high-level, and composite innovation, will be conducted simultaneously with theoretical teaching. The Multisim software virtual simulation platform, the “Pocket Laboratory” (mobile laboratory) of “Digital Electronic Technology”, and the offline open smart laboratory will collaborate to break the traditional boundaries of laboratory classrooms. For example, conducting comprehensive experiments and practical course reforms, relying on the full chain of student cognition, hands-on production, and work defense to enhance students’ learning interest and motivation, providing detailed guidance during the production process, and helping students answer questions and clarify doubts.

c) Relying on the “Electronic Design Contest”, “Internet plus Contest”, “China Robot and Artificial Intelligence Contest” and other scientific and technological competitions, create a scientific and effective innovation team, break through the bottleneck of existing teaching methods, compile new innovative practical textbooks, constantly improve students’ sense of participation and professional identity, cultivate students’ innovative practical ability and positive values. For example, forming student competition teams, setting up mechanical, electrical control, and visual groups, etc., establishing a team leader management system, forming a “old leading new” student mutual aid mechanism, building a technology innovation platform, and relying on teacher research platforms and college laboratory platforms to complete student skill training.

d) Setting up interdisciplinary open research projects online to cultivate teamwork skills; Select outstanding students, form research interest groups, match teachers’ research topics, and use online discussion forums or live streaming functions to communicate and answer questions, cultivating students’ scientific spirit of exploration in a multidisciplinary context.

e) Relying on the Science and Technology Association, we organize a science and technology cultural festival with college characteristics every year, carefully designing and producing competitions, science and technology performances, and other activities to create a strong atmosphere of science and technology culture. Introduce enterprise resources, hold subject competitions for enterprise naming,

rely on the enterprise CDIO workshop established on campus, implement the “school in factory” teaching mode, and leverage the educational function of corporate culture. Students go to school enterprise cooperative enterprises for production internships, complete their graduation projects, and achieve the integration of vocational ability training and enterprise research and development by doing real exercises, in order to cultivate and nurture students’ professional qualities.

### **3) Integrating the OBE concept to create a data-driven, process-oriented, and sustainable evaluation system for the effectiveness of ideological and political education in courses**

a) According to the hardware and software equipment required for curriculum reform, the effectiveness of ideological and political education in the curriculum and student evaluation will be included in the year-end evaluation. By analyzing the achievement of students’ ideological and political goals through data from Rain Classroom and the MOOC platform backend, a map of the effectiveness of students’ ideological and political education is obtained. b) Develop clear, specific, and quantitative curriculum ideological and political evaluation methods for each learning outcome, and establish a regular online and offline evaluation mechanism for the “Digital Electronic Technology” course. Online setting of role model videos, knowledge point-related story videos, and explanatory animation videos, allowing students to experience the charm of knowledge firsthand; Reviewing the past offline to learn new things, reproducing scenarios, enhancing students’ interest in learning, and helping them better understand knowledge points. c) In the course assessment and evaluation system, a comprehensive evaluation index system that combines scientificity, guidance, flexibility, and comprehensiveness is constructed. The “three engine” (diagnostic evaluation of academic situation, process evaluation, and summative evaluation) assessment and evaluation model is formed by using diagnostic evaluation, process evaluation, and summative evaluation methods based on learning situations. Based on MOOC backend student data (survey questionnaires, student homework scores, student participation rates, etc.), and with the help of graduate teaching assistants, the trajectory of students’ thoughts, ideas, and emotional development after various teaching practices outside of class and in class is observed and analyzed in practical teaching activities. The performance and teamwork ability of students in practical activities are observed and analyzed, and a course comprehensive evaluation report is formed. d) Explore the introduction of value-added evaluation mechanisms, develop competency-based value-added indicators and social value-added indicators, attach importance to personalized development, improve teaching strategies, timely discover and solve existing problems in the evaluation process, and form a multi-channel data collection method and continuous improvement mechanism for the “Digital Electronic Technology” course.

## **4. Limitations**

The whole teaching process relies on the online digital teaching platform, which

puts forward high requirements for students' network access conditions and platform operation ability, and there is a small number of students with low digital literacy who have adaptation obstacles in the early stage of the reform.

## 5. Conclusions

This article mainly focuses on the reform and practice of ideological and political teaching mode in the course of "Digital Electronic Technology", continuously expanding students' learning horizons, combining online and offline mixed mode, integrating ideological and political teaching videos and deeds, promoting the development of students' professional literacy, and cultivating their innovative thinking.

1) This article is guided by the engineering education certification standards and constructs a "5 + 5 + 3" curriculum for "Digital Electronic Technology" that integrates ideological, political, research, and creative education.

2) This article constructs a "three-level progressive" innovation practice capability cultivation system that deeply integrates digital information technology.

3) This article integrates the OBE concept to create a data-driven, process-oriented, and sustainable evaluation system for the effectiveness of ideological and political education in courses.

## Funding

2024 Guangxi Higher Education Undergraduate Teaching Reform Project: Exploration and Practice of Blended Teaching Mode for Digital Circuit Course under the Background of "Double Ten Thousand Plan" (2024JGB222); The 2025 Collaborative Education Project of the Ministry of Education focuses on the research and practice of the interdisciplinary integration of industry and education in the field of robotics engineering, with a focus on the integration of three elements, four elements, and five aspects of education (250503084133104).

## Conflicts of Interest

The authors declare no conflicts of interest.

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