

# China's new era applied university—Integration and development of civic and political education and electrical engineering disciplines

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**Abstract:** To address a gap in applied engineering education—namely, the disconnect between technical proficiency and professional ethics and social responsibility—this study explores the integration of Civic and Political Education (CPE) into the electrical engineering curriculum. The research aims to cultivate “complex electrical engineering professionals” who possess both advanced technical expertise and a robust ethical framework aligned with the transformation of modern energy systems. By repositioning CPE as a localized implementation of international engineering ethics and sustainability-oriented Science, Technology, Engineering, and Mathematics (STEM) education, this paper proposes a “trinity” teaching framework. This model integrates social values, practical skills, and knowledge training through a multidimensional approach. Using the core course “Fundamentals of Electrical Engineering” as a longitudinal case study, the study implemented a “dual-mentor” system that combines academic faculty with industry experts, and incorporated high-level engineering case studies, such as ultra-high-voltage (UHV) direct current transmission and “Hualong One” nuclear technology, into the curriculum. Empirical observations and student evaluations indicate that this integrated model enhances knowledge retention and professional identity. Specifically, the introduction of complex fault calculation simulations using Matrix Laboratory (MATLAB) significantly improved students’ problem-solving accuracy and logical reasoning skills compared to traditional manual methods. Furthermore, qualitative feedback indicates a significant increase in students’ awareness of global sustainable development goals, national pride, and professional integrity. This study provides a systematic, interdisciplinary framework that bridges the gap between macro-level policy objectives and classroom instructional design. It offers applied universities a replicable methodology for aligning engineering curricula with global social responsibility and professional ethical standards, thereby contributing to international discussions on holistic engineering pedagogy.

**Keywords:** electrical profession; civics; teaching methods; teaching content; educate

## 1. Introduction

The 14th Five-Year Plan proposes the reform of the modern energy system, and there is a common understanding of the importance of energy at home and abroad, which has a bearing on national security and the improvement of people's happiness index, and is also an important condition for the progress of human civilisation. We are at a critical stage of the great rejuvenation of the Chinese nation, with a new round of scientific and technological revolution and industrial change on the one hand, and the fulfilment of the goal of “carbon peak” and “carbon neutrality” on the other.

Therefore, in the face of the new situation, the reform of the energy system should be closely integrated with science and technology, and actively promote the reform of the modernisation of the energy system, which can guarantee the national energy security, and also provide impetus for the rapid development of the economy of the whole society. In order to achieve both environmental and economic development, the most critical step is the reform of the power system. Energy is the main battlefield, electricity is the main force, and the comprehensive reform of the power system is an important element to promote the development of the energy system [1,2]. In order to achieve the goal of “dual-carbon”, it is necessary to construct multiple types of power generation and supply, explore distributed new energy systems, carry out in-depth construction of energy storage methods, create intelligent power distribution systems, revise the norms and rules of electric power system reform, develop the core technology of transmission and transformation, and create intelligent electrical equipment, so as to realise the sustainable development of multi-systems and multi-functional networks [3].

On this basis, electrical engineering as a major discipline, not only need to cultivate with electrical engineering, automatic control, new energy and other multidisciplinary cross-disciplinary basic theory and engineering knowledge, technical practice, innovation, dare to entrepreneurship, can be in the field of electrical engineering in the manufacture of major intelligent equipment, the safe operation of the power system, and the development of new energy technology, such as the work of the composite, application-oriented engineering and technical personnel. It is also necessary to cultivate outstanding young people with a sense of family and country and a sense of responsibility for the times. However, with the development of the times and the depth and advancement of the reform of China's university curriculum construction, the current teaching means of the electrical discipline can not meet the cultivation of engineering talents with the correct struggle goal. Electrical teachers should actively promote the educational and teaching reform of electrical courses, fully refine the ideological and political elements of the electrical professional courses, and play a good role in the silent role of ideological and political. So that the electrical students have a sense of family and country, a firm and correct goal of struggle, and better use what they learnt. The course of political education and electrical disciplines should be fully integrated in the process of classroom learning, always pay attention to current affairs, according to the current situation and social needs, adjust the teaching and training objectives, and cultivate high-level electrical skills in line with the situation and the future development trend of talents. Therefore, in the context of the new era, how to integrate and develop the Civic and Political Education and electrical engineering disciplines in applied universities has become an important issue [4,5].

The integration of ideological education with electrical engineering is fully aligned with international trends in engineering ethics education. By focusing on energy system reform and “carbon neutrality,” this model addresses the core concerns of sustainability-oriented STEM education. This study proposes an integrated framework that aligns technical training with global ethical standards, ensuring that future engineers possess both advanced technical skills and a strong sense of social responsibility.

## **2. Theoretical framework and educational rationale**

In 2016, General Secretary Xi Jinping proposed at the National Conference on Civic and Political Work in Colleges and Universities that “classroom teaching should be used as the main channel, and the ideological and political theory course should be strengthened by insisting on improvement, so that all kinds of courses and the ideological and political theory course go in the same direction and form a synergistic effect”. In 2019, the Opinions on Deepening the Reform and Innovation of School Ideological and Political Theory Course Reform and Innovation Opinions pointed out that it is necessary to “plan the overall objective of the ideological and political course curriculum, adjust and innovate the ideological and political course curriculum system, and promote the construction of the content of the ideological and political course curriculum in a coordinated manner”. In 2020, the Guidelines for the Construction of Ideological and Political Construction of Higher Education Courses pointed out that “colleges and universities should deepen the reform of education and teaching, and Fully explore the ideological and political resources of all kinds of courses, give full play to the nurturing role of each course, and comprehensively improve the quality of talent cultivation” [6–8]. Under the state's attention and guidance to the ideology and politics of the curriculum, various organisations and schools have also studied and responded positively, calling on college and university teachers to seriously study the relevant spirit, and to seek opportunities and implementation plans for the ideology and politics of the classroom. Electrical engineering has broad development prospects, with the construction of intercontinental and local areas of ultra-high voltage transmission lines, the transmission path of electric energy is getting longer and longer, which makes the technical requirements of electrical engineering become higher, and the need for skilled personnel in electrical engineering is increasing, all of which need to promote the development of the discipline.

Although Civic and Political Education is a specific teaching requirement within the Chinese context, its core objectives align closely with the global movement to promote socially responsible engineering and the integration of ethics into STEM curricula.

Internationally, engineering accreditation bodies such as ABET in the US and the Washington Accord emphasise that engineering graduates must possess not only technical competence but also an understanding of professional ethics and the societal impact of engineering solutions. Integrating macro-level ethics (such as social justice and sustainability) into core technical curricula is more effective than teaching ethics as a separate, disconnected discipline.

The ‘Trinity’ model we propose resonates with the ‘interdisciplinary ethics’ approach adopted by several leading international science and technology universities. By embedding national strategic initiatives within technical modules, we offer a localised response to the global call for values-oriented STEM education. This is analogous to European engineering programmes that integrate the United Nations Sustainable Development Goals into power systems education to foster global citizenship and environmental stewardship.

Electrical professional courses are highly practical. Teaching content and engineering production, life practice is very closely connected, and should highlight the social value, practical ability, knowledge training “trinity” of teaching objectives, so the professional knowledge of the electrical discipline of the professional curriculum is not an isolated teaching content, but contains the spirit, emotions, ideals and values of the educational guidance, these educational guidance is in line with the Civics of the electrical professional programme. Civic politics of electrical courses can use professional courses as a carrier, use the education of ideology and politics as a leader, and finally organically combine the knowledge and evaluation system of professional courses with the content, requirements and objectives of ideology and politics education [9].

The electrical profession has unique political thinking attributes. First of all, the development of China's electric power industry is relatively difficult, nearly a hundred years experienced from backward to the world's leading rapid development, especially in the field of ultra-high-voltage transmission has become an international business card, through international cooperation and exchanges have been applied to many countries in the field of electric power, in which the development of the industry's spirit of craftsmanship and role model power is very suitable for students to carry out the emotional aspects of the civics and political education. Secondly, the electric power system is currently the world's most complex human-created power supply system. The normal operation of the power system involves multiple disciplines and multiple fields, with profound scientific connotation and dialectical materialistic research methodology, which is very suitable for the cultivation of scientific literacy of students in teaching [10,11].

This study redefines the integration of values-based education into electrical engineering curricula through the lens of the Outcomes-Based Education (OBE) framework and the social responsibility formation model. We do not view “civic engagement” as an external policy directive, but rather define it as a necessary learning outcome aligned with international engineering ethics standards.

By adopting the OBE approach, the curriculum design supports the competencies required of modern engineers—particularly the ability to address complex engineering problems while upholding professional integrity and environmental stewardship. This theoretical shift moves beyond descriptive discourse to focus on how the trinity of social values, practical competencies, and knowledge training fosters a robust professional identity. Consequently, pedagogy shifts from a teacher-centered to a student-centered model, in which the societal impacts of technologies such as ultra-high voltage (UHV) transmission serve as catalysts for cultivating long-term professional ethics and social responsibility.

### **3. The trinity integrative teaching model**

#### **3.1. Theory of civics and politics of electrical courses**

The construction of electrical disciplines in the new era of applied universities should start from the goal of training electrical engineering talents, adhere to the

overall development of moral education, physical fitness, beauty and labour, abide by the principle of people-oriented, serve the country, society and students, sum up the practical experience of electrical course ideology and politics, and build the idea of “docking with the needs of the national society and serving the development of the regional economy” to achieve the goal of cultivating complex engineering talents with “national sentiment and social responsibility”. The training goal of complex engineering talents with “national sentiment and social responsibility” is achieved. The implementation plan is based on the current needs of the times and professional development, exploring the theory of integrating Civic-Political elements into electrical professional courses, taking the concept of mastering practical skills and the goal of comprehensive human development as the theoretical basis, and designing the objectives of the courses after integrating the Civic-Political elements from the perspective of the students' needs, to promote the integration and development of the electrical disciplines and the Civic-Political education [12].

### **3.2. Course civics teaching design and implementation**

#### **3.2.1. Refine the elements of civics and politics of electrical disciplines**

According to the unique practicality and civic politics of electrical engineering, the objectives of the course are determined, and the civic politics education cases are corresponded according to the knowledge chapters and target knowledge points [13]. Establish the educational line of the course, taking Xi Jinping's thought on socialism with Chinese characteristics in the new era as the main educational line. Incorporate the spirit of craftsmanship, family and national sentiment, the spirit of innovation, and team spirit.

The green voice should be conveyed in the classroom content, the goals and measures to reduce carbon emissions should be determined, students should be guided to actively explore the innovation of electrical technology, practical training sessions should be used to enhance students' innovative spirit, and students should be encouraged to use their knowledge to solve practical problems [14].

Talk about the power system in the advanced and excellent role models, such as the State Grid, Ningbo, Zhejiang, operation and maintenance team leader Zhang Jiming is known as the “grid doctor”, through the equipment failure signal, can quickly determine the fault parts, the cause of the failure; the State Grid Corporation, the State Grid Corporation, the national model Wang Jin in the ultra-high-voltage lines in the electric overhaul. Through the power of role models to drive students to be positive, hard work.

#### **3.2.2. Infiltration of safety and political education**

Using two modules, in-class and out-of-class, in-class through the team of teachers to answer students' questions in the knowledge of safety in professional courses [15]. But electrical engineering also needs safety education, which provides security for students' experiments and employment. We build an extracurricular training base, in addition to the teachers of the professional courses, we also employ excellent alumni of the major and technical backbones of enterprises as extracurricular tutors, and make

use of the opportunity of practice to teach safety knowledge to the students, including the rules and regulations of the laboratory system, the rules of safety in the power industry and the teaching of cases of safety affairs. This will properly guide students in the operation of laboratory equipment and discipline their practical behaviour. The importance of safety rules is emphasised and the work experience behind each rule is explained in the form of cases. Work cases are shown so that students can take the initiative to analyse the causes and consequences of the cases to avoid future mistakes in the workplace.

### **3.2.3. Designing diversified civics teaching methods**

First, the Civics team teaching method, the combination of professional course teachers and Civics teachers. When it comes to the corresponding knowledge points, the Civics teacher will show students different knowledge content from the perspective of philosophy, history and other perspectives, which can broaden the students' horizons, and they can have a firm grasp of the relevant knowledge points.

Secondly, the practice teaching method. By inviting the outstanding alumni of this profession and the technical backbone of the enterprise to participate in the teaching of the course, the students can really feel how to transform the theoretical knowledge into the field application in the factory, which can greatly promote the initiative of the students on the practice of knowledge, and the knowledge problem can be solved in the field on the spot.

Third, the task-driven method. To arrange the corresponding knowledge tasks for students, they complete the corresponding tasks through teamwork, and show them through their own language.

We establish real-time linkage between inside and outside the classroom through a variety of course designs for Civics teaching. Civic and political education is carried through to every knowledge point, giving full play to the advantages of combining theory and practice, and forming a strong working team with professional teachers and excellent alumni of the profession and technical backbones of enterprises. Not only is it conducive to the absorption of students' knowledge points and the content of ideology and politics, but it also lays a good foundation for students to form a good outlook on employment and professional ethics [16].

This paper takes the electrical class professional course electrical engineering foundation as an example, develops the teaching design scheme which integrates the Civic politics element, and uses examples to show the Civic politics implementation scheme of the electrical class professional course. From theoretical knowledge learning to practical training, practical scene teaching is integrated into the course of Civics. Give full play to the respective advantages of theoretical tutors and practical tutors to create a good teaching environment, tailor the knowledge system for students, and promote the integration of Civic and Political education into the electrical discipline.

### **3.3. Evaluation methodology and data sources**

This study validated the effectiveness of the 'Trinity' teaching model using a combination of quantitative analysis and qualitative assessment [17].

Sample Size and Participants. The study drew its sample from 120 undergraduate

students majoring in Electrical Engineering and Automation at Dezhou University. Class 1 of the 2023 cohort (60 students) served as the experimental group, adopting the novel teaching model integrating ideological and political education proposed in this paper; Class 1 of the 2022 cohort (60 students) served as the control group, adopting a traditional, purely technology-oriented teaching model.

**Data Collection Instruments.** **Structured Questionnaire:** Upon completion of the course, the ‘Electrical Engineering Professional Identity and Professional Ethics Evaluation Scale’ was distributed, employing a five-point Likert scale (1–5). A total of 115 valid questionnaires were collected. The Cronbach’s Alpha reliability coefficient for the questionnaire was 0.85.

**Course Assessment Data.** Final examination results and MATLAB laboratory report marks for the ‘Ultra-High Voltage Direct Current Transmission Simulation’ and ‘Complex Fault Analysis’ modules in the ‘Fundamentals of Electrical Engineering’ course were extracted from both classes.

**Teaching Observations.** A dual-tutor team (comprising an academic tutor and an industry expert) recorded and assessed 3 group discussions and 2 on-site practical sessions conducted by the experimental class.

**Assessment Criteria.** The assessment focuses on comparing changes in students’ performance across three dimensions: technical proficiency, industry awareness, and sense of social responsibility. The results are summarised in **Supplementary material Table S1**.

## **4. Results and empirical analysis**

Take the electrical professional course “Electrical Engineering Fundamentals” as an example, from the teaching method, content and form, study the integration of political education and electrical engineering disciplines [18].

### **4.1. Characteristics of the “Fundamentals of Electrical Engineering” course**

“Electrical Engineering Fundamentals” is an electrical core professional course that will be offered in electric power engineering and automation majors. The main content includes the current situation and development prospects of China's electric power industry, the classification of power system load, the main equipment of the power system, wiring, and power system short circuit calculation. Through the study of this course, students are enabled to have a preliminary understanding of power system engineering and master the basic calculation and analysis methods. Nowadays, with the accelerated development of a new round of industry and the key task of protecting the environment, the power grid is an important link in the reform of the energy system. Especially in the ultra-high voltage transmission lines, energy storage, distributed new energy and other aspects continue to have patriotic and excellent skilled personnel. Therefore, it is of great significance to actively explore the construction of Civics and Politics in this course.

## 4.2. Teaching methods and curriculum in civics

The delivery of classroom knowledge is characterised by a multi-dimensional interplay of factors. In terms of delivery formats, there is a shift from traditional large-scale face-to-face lectures towards blended small-group seminars that combine online and offline elements; in terms of the distribution of authority, there is a move away from a teacher-centred approach towards a learning community that emphasises active student participation; and in terms of teaching methods, a variety of approaches—including lectures, case studies and project-based learning—are employed to achieve a transition from the mere imparting of knowledge to the cultivation of skills.

When in the process of teaching electrical engineering courses, the main presentation of the construction of the Civic and political construction for implicit teaching, to avoid the hard direct instillation. To realise the infiltration of ideology and politics, expand the connotation of ideology and politics, the use of “resonance” teaching concept, to adapt to the characteristics of contemporary college students of the Internet aborigines, resonate with students in the design of teaching, teaching means with the help of the Internet to open up the wisdom. To teach by example is better than words: hear the thunder in the silence, and see the flowers in the colourless place [19].

It mainly includes the categories of emotional inculcation, career development and ability cultivation. For each type of Civics, they correspond to different organisational methods and elements of Civics, which are analysed as follows.

### (1) Emotional cultivation

The “Fundamentals of Electrical Engineering” course is both a professional course and a basic course, which is conducive to students' comprehensive understanding of the electric power system. China's electric power core technology is booming. The need for the joint efforts of the majority of students requires students to firmly grasp the professional knowledge, and to dig deeper into the basic knowledge of electrical engineering philosophy of life contained in the knowledge points, which can help students set up the correct core values. Through the combination of cases and knowledge points, we can inspire students' patriotic passion and national pride, mould a strong and positive personality, and create students' craftsmanship.

### (2) Career development

In the case of adding model workers and excellent role models in the work of the power system, through the power of role models to students to establish a correct view of the career, through the growth experience of role models, college students can absorb valuable work experience, and set the goal of working hard for it. Reflect the due value of life in the relevant workplace, according to the needs of society, to carry out the relevant problem-solving. Work hard in the power system, use the knowledge they have learnt, transform the results, and contribute to the frontiers of power system development.

### **(3) Capacity development**

Through the on-site guidance of the off-campus tutors, students make use of their existing knowledge base to solve on-site problems, find out the problems in the process of practice, and improve their ability of innovation and practice. As future power system practitioners, students should have the ability to use advanced tools to solve complex engineering problems, make full use of the team's strength, arrange the roles of team members, and use simulation tools, programming tools, etc. in the process of problem solving, so as to cultivate future senior engineers engaged in the relevant production or scientific research work.

#### **4.3. Teaching content and course ideology**

Based on the content of the chapters of the “Fundamentals of Electrical Engineering” course, mining matching elements of the ideology, to achieve the “infiltration” ideology, from the above three aspects to strengthen the students' ideological education, and some of the cases to illustrate [20].

##### **(1) Case 1: The “Golden Card” of energy to the World-China's extra-high-voltage DC transmission technology**

Knowledge point: Power system voltage level.

Civic and political point: Chinese cultural self-confidence and self-improvement, cohesion of the national spirit of greatness.

Case mining ideas: this knowledge point is mainly about the power system voltage level classification, China's vast territory, the need to build ultra-high voltage transmission lines to reduce network losses and improve transmission efficiency, and the current ultra-high voltage transmission technology from the design of the key electrical equipment to achieve 100% localisation, to enhance the students' positive spirit.

Teaching and learning integration pathway: from textbook knowledge continued to the expansion of the video, and then summarised. The video mainly features Li Licheng academician as an expert in ultra-high voltage flexible DC transmission, from a penniless condition after continuous efforts and innovation, which will be China's first ultra-high voltage power transmission project put into operation. Making the “West to East” kick off, the western power through the grid to the eastern region, can solve the problem of insufficient electricity, and stimulate students' sense of national pride.

Teaching reflection: Through the relevant video playback, students can deeply appreciate that the old generation of power experts has injected a lifetime of energy into the development of the country and society. It is conducive to stimulating students' enthusiasm for learning and transforming knowledge into the ability to serve the motherland.

##### **(2) Case 2: The nuclear power technology “Hualong One” out of the country**

Knowledge point: power system power plant categories.

Civic and political point: Belt and Road “electricity” connected, China-Pakistan

friendship “power” development.

Case study idea: This knowledge point focuses on the types of power plants, especially the third-generation nuclear power technology independently developed by China. In order to achieve the “double carbon” goal, we need to reduce the use of fossil energy, so a high-efficiency, energy-saving nuclear power plant is an important development content. China's independent research and development of safe and efficient nuclear power technology, and through the construction of the Belt and Road, this is China's first overseas export of new nuclear power units, which is conducive to the use of electricity in Pakistan.

Teaching reflection: through practical teaching, students have a deeper understanding of the development of China's nuclear power technology, cutting-edge technology, and know the results achieved by China's construction of the Belt and Road. Combining professional knowledge with national strategic objectives, promoting the development of advanced technology and solving practical problems of the country is conducive to the formation of professional and technical personnel's professionalism.

**(3) Case 3: The ability to use simulation software to solve practical complex problems—power system short circuit calculation**

Knowledge point: power system short circuit calculation.

Thinking point: the use of simulation software to solve practical problems in the field of capacity.

Case mining ideas: this knowledge point about the principle of power system short-circuit calculation and the corresponding fault points, first of all, students need to master the short-circuit calculation of the relevant knowledge points, to be able to answer the question with the hand calculation method, and then expand the hand calculation to the programming language to achieve the calculation of the problem. Through the comparison of hand calculations and simulation software, students will be able to understand more deeply that continuous innovation is needed to achieve the simplicity of complex problems.

Teaching integration pathway: after mastering the short-circuit calculation hand calculation method, let students practice the Matlab programming machine calculation method. From theory to practice, the calculation efficiency and accuracy of the two methods are compared, and the superiority of modern tools is highlighted in the comparison.

Teaching reflection: By setting up specific cases, the process of programming using simulation software can cultivate students' logical thinking ability, and the output of the programme results can bring students a great sense of achievement, which makes students maintain their interest in the relevant knowledge and subsequent learning. It allows students to better understand the significance of short-circuit calculations, and also allows them to master the ability to use advanced tools to solve complex problems in practice.

This paper has achieved positive results through empirical validation and received positive feedback from students; the preliminary feedback on the evaluation index system and its integration into teaching is summarized in **Supplementary material**

Table S2.

## **5. Discussion**

### **5.1. Synergy between cognitive load and affective cognition**

Traditional electrical engineering teaching (such as the symmetrical component method and power flow calculations) typically involves a very high cognitive load, which often leads to students feeling daunted by the subject matter [21].

This study found that by incorporating case studies of major national projects such as ‘Ultra-High Voltage Transmission’ and the ‘Hualong One’ nuclear reactor, the teaching approach not only provided physical models but also stimulated students’ emotional engagement. According to self-determination theory, this sense of honour was transformed into intrinsic motivation for learning. When tackling complex short-circuit calculations in power systems, the experimental group demonstrated greater perseverance than the control group. This indicates that the incorporation of ideological and political elements did not distract students, but rather enhanced their psychological resilience when addressing highly challenging technical problems by reinforcing their sense of professional mission [22,23].

### **5.2. Tacit knowledge and ethical reconstruction under the dual-mentor system**

The “dual-mentor system” in this study represents not merely a combination of teaching resources, but also the transmission of tacit knowledge.

Industry experts bring not only technical specifications but also a “sense of engineering ethics in practice”. For instance, during discussions on power dispatch, real-life decision-making cases shared by industry experts regarding the principle that “grid safety takes precedence above all else” transformed abstract professional ethics into concrete, actionable professional conduct. Throughout the empirical process, students began to actively explore the dialectical relationship between technical parameters (such as voltage levels) and social impacts (such as energy equity and carbon peaking targets). This shift from a ‘purely technical perspective’ to a ‘systemic engineering perspective’ is precisely the core objective of applied universities in cultivating multidisciplinary talent [24].

### **5.3. Scalability and boundary conditions**

The ‘Trinity’ framework developed in this study has achieved significant results in the electrical engineering programme, but its wider application is subject to certain boundary conditions. The model is best suited to engineering courses characterised by “high technical complexity and strong social relevance”. For highly abstract fundamental theory courses, the integration approach must be more subtle to avoid a sense of disengagement caused by a “one-size-fits-all” application. Practice at Texas University demonstrates that successful integration relies on institutional support at the university level, such as the depth of industry-academia cooperation agreements and the allocation of teaching and research funding. This suggests that other universities should simultaneously optimise

their management systems when adopting this approach [25,26].

#### **5.4. Limitations and pathways for continuous improvement**

Although this study has yielded positive conclusions through comparative experiments, the following limitations must be acknowledged. Current assessment methods (such as end-of-term examinations and questionnaires) focus on immediate teaching feedback. Whether students' professional ethical conduct remains stable in the long term after entering actual workplaces such as power grid enterprises and nuclear power stations requires a longitudinal tracking study spanning 3–5 years.

Due to experimental constraints, the sample in this study was drawn from a single institution. Future research should involve inter-institutional collaboration and incorporate samples from different levels (such as vocational colleges and research-intensive universities) to verify the universality of this model.

### **6. Conclusion**

Applied universities play a vital role in constructing electrical engineering disciplines that bridge technical expertise with professional ethics. This study provides a systemic framework for integrating value-based education into the curriculum, centering on a “Trinity” model that encompasses social value, practical ability, and knowledge training. Preliminary observations from the implementation in the “Electrical Engineering Fundamentals” course suggest that utilizing high-profile engineering cases, such as Ultra-High Voltage Direct Current (UHVDC) technology and “Hualong One”, effectively enhances students' professional identity and their understanding of global sustainability goals. Furthermore, the transition from theoretical manual calculations to simulation-based problem-solving has shown initial success in improving students' logical reasoning and accuracy. While these results indicate a positive trend in cultivating socially responsible engineering talents, the authors acknowledge the need for longitudinal empirical studies to further validate the long-term impact of this integrated pedagogy on professional development. This research offers a reproducible methodology for the integration of discipline development and ethical education in the new era of applied universities.

**Supplementary material:** The supporting information can be downloaded at <https://ojs.acad-pub.com/public/FES-3378-Supplementary-material.docx>.

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