The Reform of Practical Course Construction for the Electrical Engineering and Automation Major under the Background of IEET Engineering Education Accreditation

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Abstract: Based on the IEET engineering education accreditation standards, this paper ystematically explores the reform pathways for the practical teaching system of the Electrical Engineering and utomation major. Addressing current issues such as the disconnection between theory and practice, insufficient industry experience among faculty, and inadequate teaching resources, the study proposes a teaching model centered on the "Triple Integration" (industry demands - core competencies - core courses). It constructs a comprehensive reform framework encompassing practical education objectives, content systems, support mechanisms, and evaluation systems. By establishing a "four-year integrated" practical operation mechanism, strengthening industry-academia collaborative education, cultivating a dual-qualified teaching team, and optimizing practical teaching platforms, the study develops a practical teaching system characterized by "personalization, dual channels, three integrations, four levels, and diversification". Innovatively, it designs an evaluation index system covering four dimensions: practical teaching environment, construction and management, faculty reform, and student outcomes. Practical results demonstrate that this reform approach effectively enhances students' engineering practice and innovative design capabilities, providing a replicable implementation path for cultivating high-quality engineering talents that meet the demands of intelligent manufacturing development. The study offers valuable insights for advancing practical teaching reforms under the framework of engineering education accreditation.

Keywords: Engineering Education Accreditation; Practical Teaching System Reform; Triple Integration; Industry-Academia Collaborative Education

1. Introduction

With the rapid development of society, the cultivation of professionals in Electrical Engineering and Automation has become particularly crucial. As one of the key disciplines in engineering education, students in this field must possess not only a solid theoretical foundation but also substantial practical experience to meet the evolving demands of our information-driven era [1,2]. There exists a significant disconnect between conventional theoretical instruction and practical training, rendering them inadequate to meet the demands of today's rapidly evolving society. To address this critical issue, immediate reforms and innovative explorations are imperative [3]. Meanwhile, it is imperative to align with the requirements of IEET (Institute of Engineering Education) accreditation to drive the reform of practical course development [4]. Only through systematic restructuring and optimization of practical courses can we effectively cultivate students' comprehensive competencies and innovative thinking, thereby enhancing their competitiveness in the field of electrical engineering and automation. This paper examines the reform and development of the practical curriculum system for Electrical Engineering and Automation under the framework of IEET engineering education accreditation, aiming to provide valuable references for improving educational quality in this discipline [5]. The IEET Engineering Education Accreditation is an international certification awarded by the IEET. This accreditation system aims to evaluate and enhance the teaching quality of engineering programs while safeguarding students' learning experiences and career prospects. Typically, the IEET accreditation process encompasses comprehensive assessments of institutional resources, academic programs, and curriculum design to ensure compliance with international standards and industry requirements [6,7].

The Electrical Engineering and Automation discipline constitutes a vital component of modern intelligent electrical systems, encompassing diverse technological domains including power electronics, electrical automation, computer engineering, and electronic technologies. This multidisciplinary field demonstrates extensive application potential and promising development prospects across industrial sectors [8,9]. In the context of today's digitally transformed society, the reform of practical education in Electrical Engineering and Automation has assumed unprecedented urgency and significance [10]. Through practice-oriented instruction, students can effectively bridge theoretical knowledge with real-world engineering applications, thereby cultivating three core competencies: innovative thinking, hands-on skills, and problem-solving abilities. This pedagogical approach significantly enhances their workplace adaptability and professional competitiveness [11].

The significance of practical teaching reform in Electrical Engineering and Automation is primarily reflected in the following aspects: First, it aligns with market demands and enhances students' employability [12]. With the continuous advancement and innovation of science and technology, the market's demand for talent is constantly evolving. Reforming practical teaching methodologies can more effectively cultivate Electrical Engineering and Automation professionals who meet these dynamic market requirements [13]. Second, it facilitates professional accreditation and quality assessment while elevating educational standards. As practical training constitutes a critical component of IEET program accreditation, its reform enables better compliance with IEET certification requirements, thereby enhancing the institution's overall teaching quality and academic reputation. Third, it fosters students' practical competencies and innovative mindset, promoting their holistic development into qualified professionals [14]. Practical education serves as a crucial bridge and platform for transforming theoretical knowledge into applied competencies. Through systematic reforms in practical instruction, we can significantly enhance students' operational skills, problem-solving capabilities, and teamwork proficiency, while simultaneously cultivating their innovative thinking and hands-on expertise - thereby establishing a solid foundation for their future professional development.

2. Analysis of Current Practical Teaching Conditions

Against the backdrop of rapid technological advancement, the Electrical Engineering and Automation discipline has grown increasingly vital in cultivating high-caliber engineering professionals capable of excelling across diverse fields including power systems and industrial automation. However, significant challenges persist in its practical education framework: the curriculum remains disproportionately theoretical with limited practical components, featuring outdated verification-based experiments that fail to connect with real-world engineering applications or stimulate innovative thinking; meanwhile, faculty members' prolonged academic isolation and lack of frontline industry experience result in practice-oriented guidance that lacks practical relevance, severely hindering students' ability to translate theoretical knowledge into operational competencies [15]. Moreover, the practical teaching system faces severe resource constraints: aging laboratory equipment with insufficient quantities, underdeveloped off-campus internship platforms, and inadequate exposure to authentic engineering environments collectively impede students' hands-on training. These limitations, compounded by ineffective management practices and incomplete instructional materials, fundamentally constrain the overall quality enhancement of practical education.

3. Exploration of Practical Teaching Reform

3.1 Significance of Practical Teaching Reform

The significance of practical teaching reform lies in its multidimensional enhancement of students' professional competencies: it systematically develops applied technical skills and problem-solving capabilities while effectively stimulating learning motivation and strengthening hands-on operational proficiency. By bridging theoretical knowledge with practical implementation, this reform deepens comprehension and application of specialized content, simultaneously cultivating innovation mindset and collaborative teamwork - critical attributes that build professional competitiveness. For Electrical Engineering and Automation students, such transformation is indispensable in developing industry-ready expertise, as it directly addresses workforce demands through curriculum modernization. Only through continuous pedagogical innovation and quality improvement can institutions ensure graduates' employability and drive the discipline's advancement in our technology-driven era.

3.2 Reform of Practical Education Cultivation Program for Electrical Engineering and Automation

Guided by IEET engineering accreditation requirements, an in-depth analysis of the current talent development program for Electrical Engineering and Automation has led to the following reforms:

3.2.1Reform of practical education objectives

Based on the composition of competencies and skills, the overarching practical teaching objectives are further delineated into sub-goals: Professional Awareness, Technical Skills Mastery, Comprehensive Application Ability, Entrepreneurship and Innovation Capability, Supporting Skills and Qualities for core technical competencies.

3.2.2 Reform of the talent development content system

The practical teaching system for the undergraduate Electrical Engineering and Automation program is constructed in compliance with national standards and guided by modern macro-engineering education principles. By integrating outcome-based and demand-driven pedagogical approaches, it achieves the "Triple Integration" of Dongguan's regional intelligent manufacturing industry requirements, the program's core competencies, and its fundamental coursework. This establishes an industry-oriented instructional model emphasizing outcomes, hands-on practice, self-directed learning, enhanced design, and innovation stimulation, ultimately forming a "personalized, dual-channel, three-integrated, four-tiered, and diversified" practical education framework that specifically cultivates students' capabilities in innovative product design and automated equipment programming/debugging within the electrical engineering domain.

3.2.3 Reform of the talent development support system

The quality assurance system for practical teaching in Electrical Engineering and Automation is illustrated in Figure 1. This system effectively implements Total Quality Management (TQM) principles into practical teaching objectives through a dynamic framework that enhances process control, inspection, and evaluation during implementation, while establishing cyclical review mechanisms for continuous improvement. The comprehensive system consists of six core components: (1) practical teaching operation mechanism, (2) applied industry-academia-research collaboration, (3) practice-oriented faculty development, (4) practical teaching environment, (5) advanced teaching technologies, and (6) financial support mechanisms. The reform establishes a four-year integrated operational mechanism for practical teaching, systematically bridging theory and practice while breaking down disciplinary barriers to create synergistic learning experiences combining experiments, design, fabrication, internships, and debugging. Key initiatives include: (1) enhancing applied industry-academia-research partnerships; (2) developing high-caliber dual-qualified faculty through recruiting industry experts with strong theoretical-practical balance, facilitating faculty industry placements, professional certification programs, and adjunct professor appointments; (3) building comprehensive teaching infrastructure encompassing on-campus practice bases, experimental centers, discipline-specific labs, and off-campus industry-education platforms; (4) deploying advanced instructional technologies including CAD/CAM systems, multimedia tools, virtual simulation, and networked learning environments; (5) implementing a robust funding mechanism featuring practice-oriented investment policies, diversified financing channels, and performance-based allocation tied to infrastructure projects, pedagogical reforms, and measurable teaching outcomes.

3.2.4 Reform of the talent development evaluation system

With the continuous development of regional electrical engineering and automation industries, enterprises in electrical automation and intelligent manufacturing are placing increasing emphasis on the practical abilities of high-quality applied talents. This trend has driven universities to evolve their practical teaching systems toward greater diversity, modularity, and multi-level integration. The traditional content, assessment methods, and evaluation systems of practical teaching can no longer comprehensively reflect students’ overall practical competence and engineering application skills, making systematic reform and optimization necessary. Constructing a scientific and reasonable quality evaluation system for practical teaching is a complex and systematic task, involving multiple components and participants throughout the practical training process in the field of electrical engineering and automation. The evaluation system is characterized by multiple stakeholders: internal participants include teaching administration departments, laboratory management teams, and internal academic experts, while faculty members comprise both course instructors and peer reviewers. In addition, deep cooperation with industry is crucial to improving practical teaching quality. It is important to actively involve partner enterprises in the talent cultivation process and jointly establish an evaluation system aligned with industry demands. During practical teaching, real-world production projects should be incorporated into internships and graduation project topics, enabling students to closely integrate classroom knowledge with hands-on experience. This enhances their comprehensive application ability, innovation capacity, and job readiness, thereby fostering applied talents with strong core professional skills who meet the practical needs of enterprises. The structure of the practical teaching quality evaluation system is shown in Figure 2.

To more comprehensively and objectively reflect the actual quality of practical teaching, the Electrical Engineering and Automation program has refined the original four primary evaluation indicators from multiple dimensions, further breaking them down into several secondary indicators, each with clear and specific assessment requirements. The practical teaching evaluation index system, as shown in Table 1, covers aspects such as the completeness of teaching content, the standardization of the teaching process, the achievement of teaching outcomes, and the effectiveness of teaching support. The establishment of this system helps enhance teachers' awareness of standardization and responsibility in practical teaching, while also strengthening students' attention to practical courses. At the same time, it provides an important basis for the school to comprehensively understand the operation of practical teaching in the program, identify and address problems in a timely manner. Through this scientific and systematic evaluation framework, the continuous improvement of practical teaching quality can be effectively promoted. Moreover, it facilitates the alignment of teaching content with actual enterprise demands, providing strong support for cultivating application-oriented talents with engineering practice capabilities and innovative thinking.

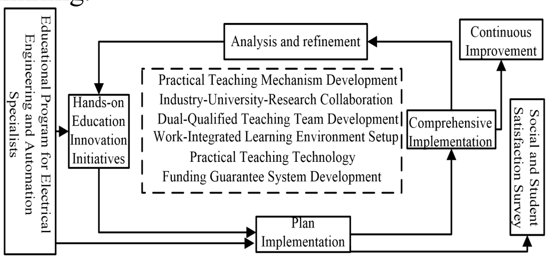

Figure 1. Architecture of the Practical Teaching Quality Assurance System for Electrical Engineering and Automation

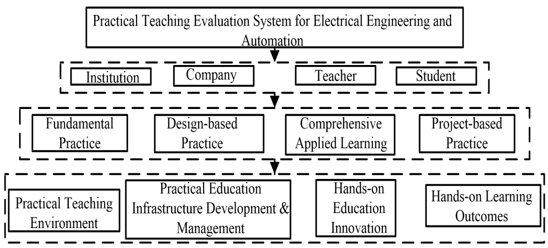

Figure 2. Practical Teaching System

Table 1. Evaluation Index System for Practical Teaching in Electrical Engineering and Automation Specialty

Primary Indicators	Secondary Indicators
Practical Teaching Environment	1.Construction of laboratories and training rooms
	2.Development of practical teaching bases
	3.Development of dual-qualified teaching teams
Management of Practical Teaching	1.Documentation management of professional and practical course development
	2.Regulations for laboratory construction and management

Development	3.Management of graduation projects (theses)
	4.Quality monitoring of experiment, internship, and project reports
Quality and Reform of Teachers' Practical Teaching	1.Quality management of teaching reform papers related to practical instruction
	2.Reforms in practical teaching research projects
	3.Innovation and reform in practical teaching
Effectiveness of Students' Practical Learning	1.Assessment of basic professional knowledge and skills
	2.Assessment of core professional competencies
	3.Assessment of comprehensive application abilities
	4.Assessment of innovative design capabilities

3.3 Key Components of Practical Teaching Reform

Here is a professional translation of the entire text into a cohesive paragraph:

"Comprehensive reforms in practical teaching for Electrical Engineering and Automation focus on seven key aspects: (1) Enhancing practical teaching components by expanding hands-on content, upgrading lab equipment, and improving facilities to strengthen operational skills and engineering application abilities; (2) Extending project-based learning through industry collaborations that incorporate real enterprise projects into curricula to boost industry awareness; (3) Intensifying internship training by increasing practical course hours and requirements to cultivate innovation capabilities; (4) Modernizing practice environments including labs and training bases while developing online platforms to improve engagement; (5) Strengthening management systems through standardized regulations for equipment maintenance, safety protocols, and process documentation; (6) Innovating assessment mechanisms using multi-dimensional evaluation by both academic and industry experts based on project implementation, technical reports, and professional attitude; (7) Restructuring the evaluation framework with a five-dimensional index system covering teaching conditions, lab management, instructional quality, pedagogical innovation, and learning outcomes - creating a comprehensive assessment system aligned with international engineering education standards and industry requirements".

4. Conclusions

This study systematically investigates the reform pathways and practical outcomes of the practical teaching system in Electrical Engineering and Automation based on IEET engineering education accreditation standards. By reconstructing a four-dimensional practical education framework ("professional cognition - skill training - comprehensive application - innovation & entrepreneurship") and establishing a tripartite teaching model integrating "industry demands, core competencies, and core courses," we have developed a four-year integrated theory-practice cultivation system. The research innovatively constructs a quality assurance system comprising six modules (operational mechanisms, industry-academia-research collaboration, dual-qualified faculty, teaching environment, technology application, and funding support), along with a diversified evaluation index system covering teaching environment, construction management, faculty reforms, and student outcomes. Empirical results demonstrate that through strengthened enterprise project practice, updated laboratory equipment, and virtual-physical integrated platform development, students' engineering practice capabilities and innovative design competencies have significantly improved, enhancing graduate employability. Notably, the industry-academia collaborative "dual-supervisor system" and real-world engineering case-based graduation project models effectively facilitate the transformation of theoretical knowledge into practical skills. Future research should further explore deep integration of AI technologies in practical teaching, improve long-term industry-academia collaboration mechanisms, and strengthen alignment with international engineering education systems. These research outcomes provide a replicable reform paradigm for specialty development under engineering education accreditation, offering significant practical value for cultivating high-quality engineering talents adaptable to intelligent manufacturing development.

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