Reform and research on practice teaching system of Electronic Information Engineering specialty

Qin Fu*

Guangdong University of Science and Technology, Guangdong, China

739238760@qq.com

Abstract. This paper focuses on the necessity and implementation strategies of reforming the practical teaching system for the Electronic Information Engineering (EIE) program in local universities. In response to the rapid development of the industry, the paper analyzes the current challenges faced by universities in teaching, such as the lag in course content and limited experimental conditions, highlighting the urgency of reform. Proposed reform measures include constructing a modular curriculum system, strengthening university-industry collaboration, and introducing project-driven teaching methodologies, aiming to enhance teaching quality and students' practical abilities. Taking the course "Intelligent Electronic System Design" as an example, the paper showcases the current status of practical teaching reform implemented in five aspects of the course. Finally, the paper summarizes the reform experiences and provides an outlook on future development directions, emphasizing the importance of continuously deepening reforms to cultivate high-quality EIE talents.

Keywords: Electronic Information Engineering; Practical Teaching System Reform; Local Universities; Innovation Ability

1 Introduction

New Engineering Education (NEE) has emerged in response to a technological revolution and industrial transformation, aiming to cultivate high-quality engineering talents with interdisciplinary knowledge, innovative capabilities, practical skills, and international perspectives [1]. NEE emphasizes not only the deepening of traditional engineering disciplines but also the integration with emerging technologies like information technology, artificial intelligence, and big data. For electronics and information engineering (EIE) majors in local universities, NEE profoundly impacts professional education by maintaining traditional advantages while updating teaching content and methods, strengthening practical teaching, and fostering innovation to meet societal demands for diverse engineering talents.

Currently, EIE majors face significant challenges in practical teaching. Many universities lack sufficient resources and have outdated laboratory equipment that does not support new technologies. Additionally, the practical teaching system often fails to connect curriculum design with real engineering applications, hindering students' ability to

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apply their knowledge effectively [2]. These issues arise from insufficient funding, delayed faculty development, and poor management of practical teaching, which impede the cultivation of students' practical and innovative skills, ultimately affecting their competitiveness in the job market [3-4].

This research aims to explore reform directions for the practical teaching system of EIE majors under the NEE framework, addressing existing challenges and enhancing students' practical and innovative capabilities. The study provides theoretical support and strategic guidance for reforming practical teaching in local universities, helping them optimize resource allocation, improve teaching quality, and develop high-quality engineering talents that meet societal needs.

2 Analysis on the Necessity of Reforming

2.1 Alignment of Market Demand and Talent Cultivation

In the rapidly evolving field of electronics and information engineering, the market's demand for talent exhibits a trend towards diversification and high-end specialization. Enterprises not only require engineers with fundamental theoretical knowledge but also aspire for compound talents with innovative capabilities and practical experience. As significant bases for talent cultivation, local universities must closely monitor market demands and, through reforming their practical teaching systems, strengthen cooperation with enterprises, introduce industry-leading technologies, and ensure that teaching content is tightly aligned with market demands [5].

2.2 Cultivation of Students' Innovative and Practical Capabilities

Under the context of New Engineering Education, students' innovative and practical capabilities have become crucial indicators for measuring educational quality [6]. The reform of the practical teaching system plays a pivotal role in nurturing these capabilities. By increasing experimental courses, implementing project-based learning, organizing innovation competitions, and other means, students' interest and initiative can be stimulated, fostering their innovative thinking and practical abilities.

2.3 Driving Discipline Construction and Professional Development

The reform of the practical teaching system significantly propels discipline construction and professional development. By reforming the practical teaching system, local universities can optimize the allocation of teaching resources, enhance teaching quality and research levels. Additionally, this reform fosters interdisciplinary integration, driving the electronics and information engineering major towards broader and deeper development. Moreover, it facilitates cooperation and exchanges between local universities and enterprises, promoting integrated industry-university-research development and providing talent support and intellectual security for the local electronics and in-

formation industry. Therefore, reforming the practical teaching system is a vital pathway for the sustainable development of electronics and information engineering majors in local universities.

3 Specific Measures for Reforming.

3.1 Optimization of the Practical Teaching Curriculum System

Guided by the educational philosophy of New Engineering, local universities need to design a practical teaching curriculum system that aligns with industry trends and emphasizes innovation and practice. This system should encompass multiple levels, including basic course experiments, specialized course training, and comprehensive project practice, to ensure that students not only master fundamental theoretical knowledge but also gain ample practical opportunities.

3.2 Innovation in Practical Teaching Methods and Means

Introducing advanced practical teaching methods and means is crucial in the teaching practice of local universities. For instance, methods such as project-based learning, problem-oriented learning, and case studies can stimulate students' interest and initiative, nurturing their innovative and practical abilities. Meanwhile, leveraging modern teaching tools like virtual simulation technology and online experiment platforms can provide students with more convenient and efficient practical learning experiences.

3.3 Establishment and Improvement of Practical Teaching Platforms

The establishment and improvement of practical teaching platforms are essential guarantees for local universities to enhance practical teaching quality. Local universities should fully utilize both internal and external resources to build a diversified range of practical teaching platforms, including laboratories, training bases, and innovation centers. Furthermore, they should continually refine the platforms' functions and services, such as providing advanced experimental equipment, abundant practical projects, and professional guidance teams, to meet students' practical learning needs.

3.4 Construction of Practical Teaching Faculty

The construction of a practical teaching faculty is a crucial step for local universities to elevate their practical teaching standards. Firstly, actively recruit talented individuals with rich practical experience and innovative spirits to join the practical teaching team. Secondly, enhance the training and development of existing teachers, encouraging them to participate in research projects, corporate practices, and other activities to boost their practical abilities and teaching skills. Lastly, establish and improve an incentive mechanism and evaluation system for the practical teaching faculty to stimulate their enthusiasm and creativity. Through the implementation of these measures, local universities

can forge a high-caliber practical teaching faculty, providing a solid foundation for enhancing practical teaching quality.

4 Case Analysis

Using the core course "Intelligent Electronic System Design" in the Electronic Information Engineering program as an example, this section highlights the critical importance of establishing a practical teaching system. Such a system is invaluable as it helps students integrate complex theoretical knowledge with practical skills, fostering innovative thinking and enhancing their ability to solve complex engineering problems independently. This foundation is essential for their future careers in cutting-edge fields like artificial intelligence, the Internet of Things, and automation control.

The content and implementation strategies of the practical teaching system for Intelligent Electronic System Design encompass the following aspects:

Theoretical Instruction: Faculty members should keep up with industry trends by integrating the latest theories, algorithms, and technologies in intelligent electronic system design. By using diverse teaching methods, such as case studies and interactive Q&A sessions, they can stimulate students' interest in the subject. Additionally, utilizing modern tools like virtual simulation platforms and online resources enhances classroom engagement, helping students build a strong theoretical foundation.

In-class Experiments: A series of targeted experimental projects should focus on topics like sensor data acquisition, intelligent algorithm implementation, and system integration. These hands-on experiments provide students with a deep understanding of intelligent electronic systems' principles and design processes. By promoting autonomous exploration and teamwork, students improve their practical skills while emphasizing innovation and practicality, allowing them to experience intelligent technology firsthand. (See Table 1 for the list of experiments in the Intelligent Electronic System Design course.)

Table 1. List of experiments in Intelligent Electronic System Design course

No.	Experiment Name	Experiment Purpose
1	Temperature and humidity sensor data acquisition and real-time display	· Master the working principles and interface methods of common sensors (such as temperature and humidity sensors). · Learn the basic flow of data acquisition and programming implementation. · The real-time collection and display of temperature and humidity data are realized.
2	Design of motor speed control system based on PID algorithm	· Understand the basic principle of PID control algorithm and parameter adjustment method. · Master the application of PID algorithm in intelligent electronic system. · The results of PID control are verified by experiments, and the parameters are optimized.
3	Intelligent environment monitoring system integrating temperature, humidity,	· Master the integrated application methods of various sensors. · Learn the overall design and debugging skills of intelligent electronic systems.

	illuminance and other sensors	· Realize an intelligent environment monitoring system with data acquisition, processing, display and alarm functions.

Course Project: This segment primarily focuses on nurturing students' comprehensive design capabilities and innovative abilities. Students are tasked with independently selecting a topic, designing, and implementing a complete intelligent system centered around a specific application scenario of intelligent electronic systems, such as a smart home system or an intelligent trash can design. Throughout this process, students must complete various stages including requirement analysis, system design, hardware selection and configuration, software programming, system testing and optimization, final product presentation, and report writing. This comprehensive approach comprehensively exercises their skills in system design, project management, and team collaboration. The following table 2 shows the list of projects in Intelligent Electronic System Design course.

Table 2. List of projects in Intelligent Electronic System Design course

No.	Project name	The main functions of the project
1	Intelligent home system design based on STM32	Environmental monitoring and control; Intelligent security; Remote control;
2	Intelligent trash can design based on STM32	Garbage overflow detection; Automatic opening and closing cover; data upload and monitoring;
3	Intelligent irrigation car based on single chip microcomputer	Soil moisture monitoring; Intelligent irrigation; Remote monitoring and control;
4	Design of multifunctional intelligent medicine box system based on MCU	Drug management; Medication reminder; Drug expiration detection;
5	Design of reversing radar system based on single chip microcomputer	Obstacle detection; Audible and visual alarm; Display interface;
6	Design of intelligent fire alarm system based on single chip microcomputer	Smoke and temperature monitoring; Sound and light alarm; Remote alarm and linkage;

Corporate Internships: Strengthening partnerships with industry and establishing off-campus internship bases allow students to engage in real-world corporate projects. This experience enables them to understand the practical applications of intelligent electronic system design in areas such as product development and maintenance, enhancing their professional knowledge and valuable practical experience, which improves their employment competitiveness.

Competitions and Project-Driven Learning: Students are encouraged to participate in intelligent electronic design competitions and technological innovation projects, providing a platform to showcase their talents. Involvement in these activities allows students to apply their knowledge to real-world challenges, develop innovative thinking, teamwork skills, and adaptability. Additionally, they can earn honors and rewards, enriching their personal growth and professional development.

5 Conclusion

This paper summarizes key insights and findings regarding the reform of the practical teaching system for the Electronic Information Engineering major in local universities. It highlights the need for reform in light of Emerging Engineering Education and discusses strategies such as optimizing the curriculum, innovating teaching methods, enhancing practical teaching platforms, and strengthening faculty development. These measures aim to improve students' innovative and practical capabilities to meet societal demands for high-quality engineering talent.

However, local universities face significant challenges, including inadequate resource allocation and outdated laboratory equipment, which impede practical teaching effectiveness. Additionally, the integration of theoretical and practical teaching, along with collaboration with industry, needs urgent attention. As new technologies and market demands evolve, local universities must continuously adapt and innovate their practical teaching systems.

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