



Research on the Cultivation of Innovation Ability in the Practice of Electrical Majors in Higher Vocational Colleges

Kuang Lu^{1,*} and Xia Song²

¹Wuhan Vocational College of Software and Engineering, No. 117, Optics Valley Avenue, East Lake New Technology Development Zone, Wuhan City, Hubei Province, 430205, China

²Wuhan Polytechnic, No. 463, Guanshan Avenue, Hongshan District, Wuhan City, Hubei Province, 430070, China

*961006381@qq.com

Abstract. The development of innovative practical skills is a critical approach to enhancing the overall competence and employability of electrical engineering students in higher vocational colleges. Given the rapid advancement of science and technology and the ongoing transformation of industrial structures, traditional teaching methodologies have become inadequate for cultivating high-caliber technical professionals required by society. Consequently, it is imperative to investigate the cultivation of innovative practical abilities among electrical engineering students in higher vocational colleges. This paper examines influencing factors such as curriculum design, practical instruction, and school-enterprise collaboration based on an analysis of relevant domestic and international literature. The findings indicate that reforming curriculum content and innovating practical teaching methods are pivotal to improving students' innovation capabilities. By incorporating teaching strategies like integrated innovation, students' innovative thinking and practical skills can be effectively stimulated. In conclusion, fostering innovative practical abilities in electrical engineering students at higher vocational colleges necessitates multi-party cooperation and the establishment of a systematic training framework through curricular reforms, practical enhancements, and pedagogical innovations, thereby meeting the demands of modern talent development.

Keywords: Innovation Practice Ability, Higher Vocational Colleges, Electrical Engineering Major, Teaching Reform, School-Enterprise Cooperation

1 Introduction

1.1 Research Background

With the rapid advancement of science and technology and the accelerated pace of social development, the cultivation of innovative practical skills has become increasingly critical in the training of electrical engineering students at higher vocational colleges.

In recent years, the government has placed greater emphasis on vocational education, stressing the importance of nurturing high-caliber applied talents to meet the demands of economic and social progress. Given the rapid technological advancements in the field of electrical engineering, it is imperative that students possess not only a solid foundation in theoretical knowledge but also the ability to engage in creative thinking and practical operations. Currently, there are notable deficiencies in fostering students' innovative practical abilities in higher vocational colleges, such as overly standardized curricula and insufficient practical teaching components, which result in inadequate preparedness for complex real-world challenges. This situation not only undermines students' professional competence but also hinders their future career prospects. Therefore, conducting in-depth research into effective methods for cultivating innovative practical skills among electrical engineering students at higher vocational colleges, and analyzing the current state, influencing factors, and improvement measures, will provide valuable insights for enhancing the quality of vocational education and positively contribute to the development of the electrical industry^[1].

1.2 Integration and Innovation

The integration of professional education and entrepreneurship education is grounded in the foundational role of professional education, with entrepreneurship education serving as an extension at a more advanced level. Entrepreneurship serves as the means, while professional education forms the bedrock upon which entrepreneurship education is built. The realization of innovation and entrepreneurship education is achieved through extensive practical activities, whereas professional education equips students with the expertise to understand, analyze, and address problems within their field. This study explores a teaching model of specialized innovation and integration that offers a novel approach for cultivating applied higher vocational talents. The "specialized innovation and integration" model ensures that electrical professional education and innovation and entrepreneurship education are deeply rooted in the electrical engineering domain and continuously integrated. By adjusting and optimizing the relationship between these two educational components, they can mutually reinforce each other and leverage their respective strengths^[2].

1.3 Innovative and Entrepreneurial Thinking

Innovative and entrepreneurial thinking signifies the ability to transcend conventional thought patterns and accurately identify development opportunities. Innovative thinking involves breaking free from traditional cognitive constraints, embracing novel concepts, activities, and methodologies to adapt to an ever-evolving social environment. This process is grounded in the accumulation of experience, knowledge, and scientific reasoning, which enables individuals to challenge established norms, explore alternative approaches, and uncover new insights. Entrepreneurship, on the other hand, entails leveraging one's knowledge and resources to generate optimal social, economic, and cultural value. Through this analysis, it becomes evident that innovation and entrepreneurship are inherently interconnected.

2 The Current Status of Innovative Practical Abilities Among Electrical Engineering Majors in Higher Vocational Colleges

In higher vocational colleges, the traditional training model for electrical engineering majors has predominantly emphasized the transmission of theoretical knowledge while neglecting practical components. This imbalance results in a deficiency of practical experience and innovation capabilities when students encounter real-world engineering challenges, making it difficult to meet industry demands. The curriculum is often structured around single-discipline courses, which hinders effective interdisciplinary integration and restricts the development of students' comprehensive abilities. In response, numerous higher vocational colleges have initiated explorations into the "integration of production and education" model. By fostering school-enterprise cooperation, internships, and training programs, these institutions aim to incorporate enterprise needs into the curriculum system, thereby enhancing students' practical skills and innovation awareness. However, the current model still encounters challenges such as inadequate enterprise participation and a disconnect between course content and actual industry requirements, necessitating further in-depth analysis and reform^[3].

3 Analysis of Factors Influencing Innovation Practice Ability

3.1 Curriculum Design

The curriculum design is a fundamental element in cultivating the innovative practical abilities of electrical engineering students at higher vocational colleges. A well-structured curriculum should integrate professional characteristics with industry requirements, emphasizing the balance between theoretical knowledge and practical application to ensure both relevance and forward-thinking. For instance, advanced courses such as intelligent electronic technology and the Internet of Things should be introduced to foster students' innovative awareness and practical skills. Additionally, the proportion of practical components should be enhanced, with systematic practical courses like project-based training and enterprise internships designed to develop students' problem-solving capabilities. Interdisciplinary learning and collaboration are also encouraged to enhance students' comprehensive qualities, enabling them to apply multidisciplinary knowledge flexibly when addressing complex engineering challenges.

3.2 Practical Teaching

Practical teaching plays a crucial role in enhancing the innovative practical abilities of electrical engineering students at higher vocational colleges. Through practical teaching, students can transform theoretical knowledge into practical skills, thereby improving their hands-on ability and fostering innovative thinking. Currently, many higher

vocational colleges employ project-driven and case analysis methods to stimulate students' creativity and practical skills. However, practical teaching faces several challenges, including inadequate practice facilities, varying instructor expertise levels, and low student engagement. To address these issues, schools should increase investment in practical teaching resources, strengthen school-enterprise partnerships, and establish comprehensive practice platforms. Teachers must update their knowledge structures, provide stronger guidance, and encourage innovative thinking and independent learning. Effective practical teaching reforms lay a solid foundation for nurturing the innovative abilities of electrical engineering students, adapting to the rapidly evolving demands of science and technology and industry.

3.3 School-Enterprise Cooperation

School-enterprise cooperation is an essential approach to enhancing the innovation and practical abilities of electrical engineering students at higher vocational colleges. With the development of the economy and society, there is an increasing demand for individuals who possess both practical skills and an innovative spirit. School-enterprise cooperation provides students with real-world practical environments, helping them understand the integration of curriculum content and practical applications. Through close collaboration with enterprises, vocational colleges can jointly develop curricula and design teaching plans that align with industry needs, promoting educational reform and updating content. Enterprises offer internship positions for students to participate in course design and implementation, ensuring that the curriculum remains cutting-edge and practical. The involvement of industry experts provides students with valuable industry experience and career guidance, stimulating their interest in learning and innovative thinking. School-enterprise cooperation also supplies high-quality talent to enterprises, achieving mutual benefits^[4].

4 The Impact of Curriculum Reform on the Cultivation of Innovative Practical Ability

4.1 Reform of Course Content

In higher vocational colleges' electrical engineering programs, reforming course content is a critical step in enhancing students' innovative practical abilities. Traditional curricula often emphasize theoretical knowledge but lack practical application components, which can hinder the development of students' innovative thinking and practical skills. Therefore, curriculum content reform should focus on aligning with actual industry needs, thereby increasing the practicality and applicability of the courses.

The "professional integration" course structure comprises three main components: foundational professional courses, specialized core courses, and advanced elective courses. Foundational professional courses provide essential theoretical knowledge rel-

evant to telecommunications majors. Specialized core courses cover key areas that foster students' practical skills and innovative spirit. Advanced elective courses aim to broaden students' knowledge and skill sets(see Fig. 1).

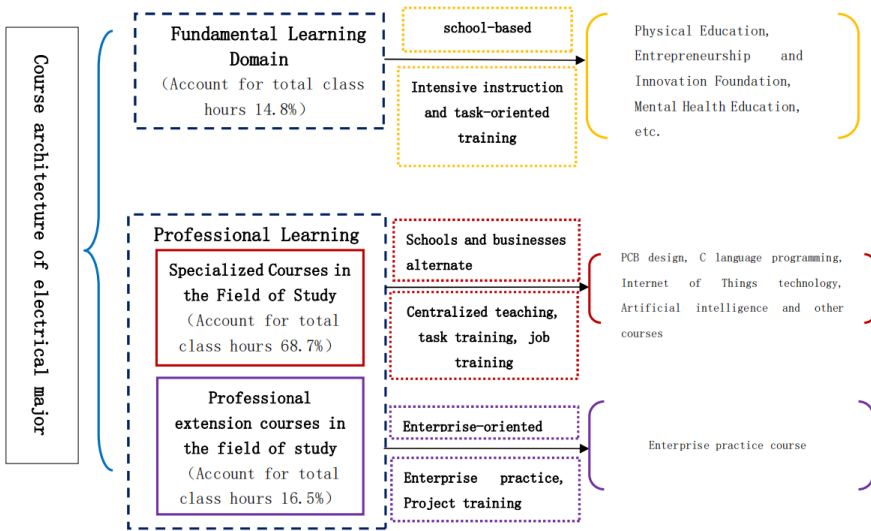


Fig. 1. A diagram illustrating this course architecture.

4.2 Innovation in Teaching Methods

As teaching reforms deepen in higher vocational colleges' electrical engineering programs, innovative teaching methods have become crucial for improving students' practical innovation capabilities. The shift from traditional didactic instruction to student-centered active learning is essential. Introducing project-based learning allows students to identify and solve real-world problems, thereby enhancing their innovative thinking. Case studies can effectively stimulate interest and develop critical thinking and practical skills through the analysis of real-world scenarios. Additionally, teachers should encourage group discussions to facilitate the exchange of ideas. Integrating multimedia, network technology, and other modern information tools into teaching can increase student engagement and interaction, thus boosting motivation. Extracurricular practical activities, such as participation in competitions or projects, not only enhance hands-on skills but also foster teamwork. In summary, innovative teaching methods significantly improve the innovative practical abilities of students in higher vocational colleges' electrical engineering programs, laying a solid foundation for their future career development(see Fig. 2).



Fig. 2. Actual Environmental Influences on Personal Development

4.3 Construction of Evaluation System

The development of a curriculum evaluation system is a critical component in enhancing the innovation and practical skills of electrical engineering students in higher vocational colleges. A well-designed and rational evaluation framework not only comprehensively reflects students' learning outcomes but also drives continuous improvement in teaching quality.

Students are expected to address multi-dimensional real-world challenges encountered during the design and implementation of innovative and entrepreneurial projects. This process should authentically demonstrate the technical competencies acquired through classroom instruction and hands-on practice, integrating theoretical knowledge with practical innovation to achieve meaningful application. Instructors should move beyond rote knowledge transmission, closely aligning teaching content with practical issues, implementing diverse evaluation methods that assess students' abilities and qualities demonstrated in solving innovative and entrepreneurial tasks. The focus should be on evaluating the enhancement of practical application skills rather than mere theoretical memorization^[5].

The evaluation approach for student coursework should transition from static assessment to comprehensive evaluation. Specifically, assessment methods and content can be flexible and varied, including experiences such as visiting off-campus enterprises, participating in simulated company recruitment exercises, writing personal resumes, preparing business plans for entrepreneurial projects, obtaining completion certificates from school innovation and entrepreneurship training camps, acquiring company registration licenses, preparing presentations for innovation and entrepreneurship competitions, creating industry competition or training videos, maintaining work logs during working days, designing electronic product hardware circuit diagrams, documenting production procedures, etc.

By documenting the learning and growth processes of students within specialized and integrated environments, their true learning situations can be comprehensively evaluated based on rich entrepreneurial achievements. The evaluation system should be closely aligned with curriculum reform and adjusted promptly according to changes

in teaching content and objectives to ensure its effectiveness and adaptability. Leveraging the insights of enterprises and industry experts in formulating and implementing curriculum evaluations will help schools better align with market demands, thereby enhancing the relevance and practicality of talent cultivation. Establishing a scientific and reasonable curriculum evaluation system can effectively promote the improvement of innovation and practical skills among electrical engineering students in higher vocational colleges, laying a solid foundation for their future career development^[6].

5 Conclusion

This paper conducts an in-depth investigation into the development of innovative practical skills among electrical engineering students in higher vocational colleges. By analyzing the current training models and the status of students' innovative practical abilities, it is evident that while some institutions have achieved certain successes in curriculum design and practical instruction, numerous challenges remain. These challenges include inadequate practical components and insufficient collaboration between schools and enterprises. The factors influencing students' innovative practical abilities primarily encompass the rationality of curriculum design, the efficacy of practical teaching methods, and the strength of school-enterprise partnerships.

In response to these issues, this paper underscores the significance of curriculum reform, which includes optimizing curriculum content, innovating teaching methodologies, and establishing a robust curriculum evaluation system. Through the integration of diverse teaching strategies such as innovation-driven practices, students' practical capabilities can be significantly enhanced. Moreover, exploring new models of school-enterprise cooperation is essential for fostering students' innovative practical skills. Deepened collaboration can facilitate the integration of industry and education, thereby providing students with broader and more comprehensive practical platforms.

In conclusion, reinforcing practical teaching, enhancing school-enterprise cooperation, and reforming the curriculum system will offer more effective support for cultivating the innovative practical abilities of electrical engineering students in higher vocational colleges.

References

1. Li, H., & Chen, J. (2020). Innovation Pedagogies in Vocational Electrical Engineering Programs. *Journal of Electrical Engineering Education*, 28(2), 89-101.
2. Wang, L., & Liu, Y. (2021). The Role of Experimental Practice in Fostering Innovation Among Electrical Engineering Students. *European Journal of Engineering Education*, 46(3), 456-470.
3. Zhao, M., & Sun, H. (2022). Integrating Industry Collaboration into Electrical Engineering Curricula for Enhanced Innovation Skills. *International Journal of Electrical Engineering Education*, 59(1), 23-35.
4. Chen, L., & Wu, X. (2023). Assessing the Effectiveness of Innovation-Centered Teaching Methods in Electrical Engineering. *Journal of Engineering and Technology Education*, 12(2), 156-170.

5. Zhang, J. (2020). The Era Significance of Vocational Education Innovation and the Cultivation of Innovation Ability. *Vocational Education Development Studies*, (03), 1-5.
6. Zhang, B. (2022). Reform and Practice of the 'Discipline Competition + Project Driven' Model for Cultivating Innovation and Entrepreneurship Abilities in Logistics Management Students at Higher Vocational Colleges. *Logistics Science and Technology*, 45(09), 175-178.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

