

The Challenges in Electrical and Electronic Technology Courses in Vocational Colleges

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Abstract: This paper addresses the challenges in the teaching of electrical and electronic technology in higher vocational colleges and proposes specific countermeasures to improve teaching quality and effectiveness. The countermeasures include optimizing teaching content, emphasizing practical application and innovation, innovating teaching methods, introducing modern instructional approaches, strengthening the teaching team, enhancing teacher quality and practical expertise, upgrading experimental equipment and facilities, enriching curriculum resources, and incorporating digital teaching materials. These measures aim to cultivate high-quality skilled talents, promote social and economic development, and enhance national competitiveness. By adjusting the course structure, incorporating real-world industry cases, and fostering collaboration with enterprises, students can better understand and apply electrical and electronic technology. The introduction of project-based teaching, flipped classrooms, and multimedia technology can enhance student engagement and facilitate independent learning. Furthermore, the improvement of experimental resources and the establishment of online teaching platforms can enhance students' practical skills and provide a variety of learning resources. These measures contribute to the overall improvement of electrical and electronic technology teaching in higher vocational colleges.

Keywords: Electrical and electronic technology; Vocational colleges; Teaching challenges; Teaching methods; Digital materials

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1. Introduction

Vocational education is an integral part of the modern education system and plays a crucial role in cultivating highly skilled talents, promoting social and economic development, and enhancing national competitiveness. With the continuous advancement of science and technology and the ongoing adjustment of industrial structure, the demand for highly skilled talents is on the rise. As a fundamental course for engineering majors in higher vocational colleges, electrical and electronic technology holds significant importance in developing students' practical skills and fostering innovative thinking.

However, the current teaching of electrical and electronic technology in higher vocational colleges faces several challenges. These include a narrow focus on teaching content, a lack of emphasis on practical application and innovation, outdated teaching methods, inadequate teaching resources and effective teaching

methods, varying teacher quality, and a lack of practical experience. Furthermore, the limited availability of experimental equipment and facilities makes it difficult to meet the experimental needs of a large number of students, resulting in outdated course resources and a lack of digital materials such as animations and videos. These issues directly impact the quality and effectiveness of electrical and electronic technology teaching. Therefore, the objective of this article is to explore strategies to address these challenges, improve the teaching quality of electrical and electronic technology, and establish a strong foundation for students' career development and future endeavors.

2. Literature review

In recent decades, extensive research has been conducted on electrical and electronic technology. For instance, Ogbu^[1] addressed the influences of inadequate instructional materials and facilities on the teaching and learning of electrical/electronic technology education courses. Ogbuanya and Onele^[2] investigated the effectiveness of desktop virtual reality for teaching and learning electrical/electronic technology in universities. Shodipe and Ohanu^[3] examined the attitude, engagement, and disposition of electrical/electronic technology education teachers toward the actual usage of mobile learning in higher institutions. Antonino-Daviu and Dunai^[4] discussed the challenges and strategies in teaching electrical and electronic engineering to multicultural groups. Zhang *et al.*^[5] presented research on the experimental teaching reform of the electronic technology course. Mi^[6] explored teaching reform in the course of automobile electrical and electronic technology. Wen *et al.*^[7] discussed the application of the project teaching method in the fundamentals of electronic technology courses. Fan^[8] focused on engineering education-oriented teaching material construction for electrical and electronic technology. Callaghan *et al.*^[9] explored the use of game-based learning in virtual worlds to teach electronic and electrical engineering. Wang^[10] discussed bridging the gap between industry and education in electronics and electrical education through information technology. Yan^[11] presented teaching reform and practice of electrical and electronic technology courses in the context of emerging engineering education. Building upon the previous research conducted by scholars and combined with frontline teaching experience, this paper aims to summarize the current problems in the teaching of this course and propose targeted solutions.

3. Challenges in the teaching of electrical and electronic technology

Electrical and electronic technology, as a fundamental course for engineering majors in higher vocational colleges, holds significant importance in developing students' practical skills and fostering innovative thinking. However, the current teaching of electrical and electronic technology faces several challenges, primarily in the following areas.

3.1. Limited emphasis on practical application and innovation in the teaching content

Currently, the teaching content of electrical and electronic technology courses in higher vocational colleges is relatively simplistic and lacks a focus on practical application and innovation. While theoretical knowledge is extensively covered, there is a dearth of practical exercises and innovative content. This hinders students' understanding of abstract concepts and principles and limits their practical experience and innovative thinking.

3.2. Outdated teaching methods and a lack of effective teaching resources

The teaching methods employed in electrical and electronic technology courses in higher vocational colleges are outdated, and there is a lack of effective teaching resources. Traditional lecture-based teaching remains the

predominant approach, which fails to engage students and ignite their interest in learning. Additionally, teaching resources are limited, and modern teaching tools and methods are lacking, thereby failing to meet the learning needs of students.

3.3. Varying teacher quality and a lack of practical experience and industry background

The quality of electrical and electronic technology teachers in higher vocational colleges varies, as some lack practical experience and industry background. This poses challenges when teaching practical courses. Moreover, some teachers lack connections with the industry and struggle to stay updated with the latest technologies and industry trends, resulting in a disconnect between the teaching content and the actual needs of students.

3.4. Insufficient experimental equipment and facilities to meet the needs of students

The teaching of electrical and electronic technology in higher vocational colleges faces challenges due to the insufficient availability of experimental equipment and facilities. This limitation makes it difficult to cater to the experimental requirements of a large number of students. Consequently, students have limited opportunities for practical experience in experimental courses, hindering their mastery of relevant knowledge and skills.

3.5. Outdated course resources and a lack of digital resources

Another issue in the teaching of electrical and electronic technology in higher vocational colleges is the reliance on outdated course resources and a scarcity of digital resources such as animations and videos. Many teaching materials and course resources are outdated, lacking the inclusion of digital resources that can aid students in better understanding and mastering abstract concepts and principles.

4. Specific measures

In response to the mentioned challenges in the teaching of electrical and electronic technology in higher vocational colleges, the following specific measures can be implemented.

4.1. Enhancing the teaching content and emphasizing practical application and innovation

Optimizing the teaching content is crucial to improving the quality of electrical and electronic technology instruction. Firstly, the course structure should be adjusted based on industry development and enterprise requirements, with a focus on practical operations and innovative content. Project-based teaching and problem-solving teaching methods can be introduced to enhance students' practical application skills and innovation awareness by guiding them to solve real-world problems. Additionally, fostering stronger collaboration with enterprises and incorporating actual industry cases and projects into classroom teaching can enrich the learning experience and help students better grasp the practical application of electrical and electronic technology.

4.2. Innovating teaching methods and introducing modern instructional approaches

Innovative teaching methods are key to addressing the teaching challenges in electrical and electronic technology. Modern instructional approaches, such as project-based teaching, flipped classrooms, and problem-solving teaching, should be introduced to engage students actively and encourage independent thinking and collaborative inquiry. Furthermore, multimedia technology and online platforms can be utilized to provide a wealth of teaching resources and learning tools, including digital textbooks, online courses, and virtual experiments, to cater to diverse learning needs. Incorporating various teaching activities, such as group discussions, debates, and skills competitions, can enhance student participation and improve learning outcomes.

4.3. Strengthening the teaching team and enhancing teacher quality and practical expertise

Building a strong teaching team is vital to improving the quality of electrical and electronic technology instruction. It is essential to provide training opportunities and resources for teachers to enhance their professional competence and practical skills. Encouraging teachers to participate in training courses, academic conferences, and industry exchange activities can broaden their knowledge and perspectives. Additionally, promoting teachers' involvement in industry practice and research activities enables them to stay updated with the latest technologies and industry trends, thereby improving the quality and effectiveness of their teaching. Establishing a teacher evaluation mechanism can foster continuous improvement in teaching quality and competence.

4.4. Upgrading experimental equipment and facilities to meet students' needs

Improving the teaching quality of electrical and electronic technology requires adequate experimental equipment and facilities. Increased investment should be made to expand and upgrade the existing resources to meet the experimental needs of students. This includes introducing advanced equipment and technology, establishing modern laboratories and training centers, and ensuring the availability of sufficient equipment. Strengthening the management and maintenance of laboratories is crucial to ensure the reliability and functionality of the experimental equipment. Implementing experimental teaching reforms, such as comprehensive and innovative experimental projects, can enhance students' practical skills and foster innovation awareness.

4.5. Enriching curriculum resources and incorporating digital teaching materials

Enriching curriculum resources is a key strategy for improving the teaching quality of electrical and electronic technology. The incorporation of digital teaching materials, such as animations and videos, can enhance students' understanding and mastery of abstract concepts and principles. Establishing a course resource library that offers diverse learning resources, including excellent courseware, teaching videos, and online self-assessment tools, can meet students' diverse learning needs and preferences. Furthermore, implementing information-based teaching reforms, such as establishing online teaching platforms, can facilitate blended learning models that combine online and offline approaches, thereby improving learning outcomes and fostering independent learning abilities.

5. Conclusions

In conclusion, the mentioned measures can effectively address the challenges in the teaching of electrical and electronic technology in higher vocational colleges. By optimizing teaching content, innovating teaching methods, strengthening the teaching team, improving experimental equipment and facilities, and enriching curriculum resources, the quality and effectiveness of instruction can be enhanced. These measures will contribute to the cultivation of high-quality skilled talents, further promote social and economic development, and enhance national competitiveness.

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Author contributions

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References

- [1] Ogbu JE, 2015, Influences of Inadequate Instructional Materials and Facilities in Teaching and Learning of Electrical/Electronic Technology Education Courses. *Journal of Education and Practice*, 6(33): 39–46. <https://eric.ed.gov/?id=EJ1083540>
- [2] Ogbuanya TC, Onele NO, 2018, Investigating the Effectiveness of Desktop Virtual Reality for Teaching and Learning of Electrical/Electronics Technology in Universities. *J. Computers in the Schools*, 35(3): 226–248. <https://doi.org/10.1080/07380569.2018.1492283>
- [3] Shodipe TO, Ohanu IB, 2021, Electrical/Electronics Technology Education Teachers Attitude, Engagement, and Disposition Towards Actual Usage of Mobile Learning in Higher Institutions. *J. Education and Information Technologies*, 2021(26): 1023–1042. <https://doi.org/10.1007/s10639-020-10297-y>
- [4] Antonino-Daviu JA, Dunai LD, 2014, Teaching Electrical and Electronic Engineering to Multi-Cultural Groups, 2014 International Conference on Optimization of Electrical and Electronic Equipment (OPTIM). Bran, Romania, 908–913. <https://doi.org/10.1109/OPTIM.2014.6850927>
- [5] Zhang C, Sun Y, Zhang X, 2021, Research on Experimental Teaching Reform of Electronic Technology Course, Innovative Mobile and Internet Services in Ubiquitous Computing: Proceedings of the 14th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS-2020). Springer International Publishing, Sanya, China, 324–333. <https://doi.org/10.1109/ICISE51755.2020.00105>
- [6] Mi X, 2018, Exploration of Teaching Reform on the Course Automobile Electrical and Electronic Technology, 2018 2nd International Conference on Management, Education and Social Science (ICMESS 2018). Atlantis Press, Qingdao, China, 28–32. <https://doi.org/10.2991/icmess-18.2018.6>
- [7] Wen L, Zheng K, Zhang B, et al., 2021, The Application of Project Teaching Method in the Course of “Fundamentals of Electronic Technology,” 2nd International Conference on Education Studies: Experience and Innovation (ICESEI 2021). Atlantis Press, Moscow, Russia, 256–259. <https://doi.org/10.2991/assehr.k.211217.039>
- [8] Fan LP, 2011, Engineering Education Oriented Teaching Material Construction for Electrical and Electronic Technology, in *Advances in Computer Science, Environment, Ecoinformatics, and Education*. CSEE 2011, Communications in Computer and Information Science, vol 217. Springer, Berlin, Heidelberg, 319–323. https://doi.org/10.1007/978-3-642-23339-5_58
- [9] Callaghan MJ, McCusker K, Losada JL, et al., 2012, Using Game-Based Learning in Virtual Worlds to Teach Electronic and Electrical Engineering. *J. IEEE Transactions on Industrial Informatics*, 9(1): 575–584. <https://doi.org/10.1109/TII.2012.2221133>
- [10] Wang QH, 2023, Electronics and Electrical Education: Bridging the Gap Between Industry and Education Through Information Technology. *J. Journal of Electrical Engineering & Technology*, 2023(19): 1–12. <https://doi.org/10.1007/s42835-023-01655-0>

- [11] Yan L, Chen R, Yang H, 2023, Teaching Reform and Practice of Electrical and Electronic Technology Courses Against the Background of Emerging Engineering Education, 2023 4th International Conference on Education, Knowledge and Information Management (ICEKIM 2023). Atlantis Press, Zhengzhou, China, 420–429. https://doi.org/10.2991/978-94-6463-172-2_47

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