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Research on Teaching Methods of Electronic Technology Courses from the Perspective of Learners

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Abstract. This paper aims to examine the issues and challenges encountered in teaching electronic technology courses from the perspective of learners. It explores the content and characteristics of the course and proposes teaching methods based on learners' cognitive foundations. By enhancing learner engagement, enabling personalized learning, employing project-driven teaching methods, and promoting interdisciplinary integration, the study seeks to optimize the teaching methods of electronic technology courses to improve teaching quality and learning outcomes. The study also analyzes the impact of teaching strategies, teaching resources, and technical support adopted by instructors on the effectiveness of teaching.

Keywords: Learner perspective; Electronic technology; Teaching methods.

1. Introduction

The General Secretary emphasized that "we must focus on the battlefield, the troops, and real combat in our teaching, aiming to cultivate talent with a focus on victory. The training of cadets should meet the needs of the military's development and future warfare. It is necessary to update educational concepts, innovate training models, improve the overall quality of the teaching staff, and forge a new path conducive to the growth of high-end military talent" [1].

Electronic technology courses, as an important component of higher education, play a critical role in developing cadets' practical skills and innovative thinking. However, these courses often involve a large amount of abstract theoretical knowledge and complex circuit analysis, which can make learning tedious and difficult to comprehend for cadets, ultimately diminishing their interest in the subject. With the increasing diversification of society, the personalized needs of cadets are also growing. Cadets from different backgrounds may have varying learning goals, interests, and methods. Addressing cadets' needs and acknowledging their difficulties is essential for aligning with them on a cognitive level.

As educational reforms deepen, the educational philosophy has gradually shifted from being teacher-centered to student-centered. In the teaching process, the primacy of cadets is becoming more prominent, and adopting a student-centered perspective reflects this philosophy. Taking the cadet's perspective means focusing more on their learning needs, experiences, motivations, and outcomes. From the perspective of learning outcomes, each cadet has their own learning style and pace. Traditional one-size-fits-all teaching methods often fail to accommodate the diverse characteristics of all cadets. Researching teaching methods from the cadet's perspective can better meet the personalized learning needs of students.

From the perspective of teaching evaluation, cadets are the direct participants and beneficiaries of the teaching process, and their feedback is an important indicator of the effectiveness of teaching methods. By studying teaching methods from the cadet's perspective, instructors can more accurately grasp the learning needs and difficulties of cadets, thereby adjusting teaching strategies, optimizing content, and making the instruction more relevant to students' realities. This personalized teaching approach not only enhances cadets' learning efficiency but also helps them build confidence, develop independent learning abilities, and inject new vitality into the reform of electronic technology courses.

2. Teaching Content Design Strategy Based on Cadet Perspective

Electronic technology courses typically cover various topics, including circuit analysis, electronic devices, digital logic, and signal processing, characterized by a wide range of knowledge points, strong practical components, and rapid updates. Cadets not only need to grasp abstract theoretical knowledge but also must apply this knowledge to practical circuit design and problem-solving. However, cadets may feel confused and frustrated by the complexity of theoretical concepts or practical operations. The diverse interests and learning goals of different cadets present additional challenges for teaching electronic technology courses. How to meet the individual needs of cadets, stimulate their interest and motivation for learning, is a crucial question that instructors must consider when optimizing and designing the teaching content. Additionally, the rapid development of the electronic technology industry places higher demands on course content. New electronic technologies and applications are emerging constantly, while textbooks often fail to keep pace with these technological changes. This requires instructors to continuously supplement new knowledge during the teaching process, while also encouraging cadets to proactively learn and adapt to new technological developments.

Through surveys, communication, and feedback, extensive input can be collected from cadets on the teaching of electronic technology courses. This feedback covers various aspects such as teaching content, teaching methods, classroom interaction, and learning resources, providing valuable firsthand information that reveals the true learning needs and expectations of cadets. Analyzing how different types of teaching resources integrate with course content requires a precise understanding of individual cadet differences to better cater to their learning needs. This step involves assessing cadets' learning styles, discussing learning motivations, and studying expectations for learning outcomes. This approach not only helps identify existing problems and challenges in teaching but also provides targeted solutions for improving the specificity and effectiveness of teaching.

In designing course content, it is essential to fully consider cadets' learning needs, cognitive characteristics, and practical abilities. Emphasis should be placed on combining theoretical knowledge with practical skills, enriching and expanding teaching resources, establishing effective evaluation and feedback mechanisms, and regularly updating and adjusting course content. Following the talent cultivation plan and course implementation schedule, the teaching content should be arranged to cover knowledge, skills, and emotional goals comprehensively. Instructors should also focus on a deep understanding of the teaching content, effectively designing classroom instruction based on cadets' foundational knowledge, and moving away from the rigid mindset of traditional teaching models. Teaching content should be organized with a cadet-centered approach, employing modular design, theory-practice integration, task-driven methods, and a blend of online and offline teaching to ensure comprehensive, easily understood content with rich, accessible resources. For topics and fields that interest cadets, elective courses or additional content can be offered. Furthermore, keeping pace with the latest developments and trends in the electronic technology field and regularly updating the course content are essential.

The following considerations apply to classroom teaching content design:

(1) Modular Design Integrated with Theory and Practice

Theoretical knowledge should be modularized, breaking down the foundational theoretical concepts in electronic technology courses, such as basic circuit theory, analog electronics, and digital electronics, into distinct modules. This modular approach enables cadets to progressively master the material, building a solid theoretical foundation. In linking knowledge points with skill points, traditional arrangements should not be rigidly followed. Modular content should be tackled piece by piece, with the logical flow of content maintained throughout. Instruction should only advance to the next stage once cadets have understood the current material.

Each module must be designed to be comprehensive, including one or more teaching points from start to finish. Within each module, theoretical and practical content should be synchronized as much as possible, with abstract concepts made concrete and tangible through experiments. For example, when teaching amplifier circuits, introducing real-world examples such as audio amplifiers can help cadets understand the function and impact of amplifiers in practical applications. The proportion of experimental courses should be increased, with projects covering fundamental circuit experiments, analog circuit experiments, and digital circuit experiments. These hands-on activities allow cadets to apply their theoretical knowledge, enhance their practical skills, and develop problem-solving abilities. For content that cannot be combined with experiments, real-world case studies should be introduced to make the knowledge easier to understand and relate to actual applications. This approach prevents knowledge from remaining abstract and disconnected from real-world contexts.

(2) Project-Driven Design

To ensure that the teaching content is coherent and comprehensive, a project-driven approach integrates background, needs, objectives, elements, idea generation, implementation, and result verification into a holistic teaching process. This method, based on constructivist learning theory, drives the learning process by guiding cadets to complete tasks, thereby achieving educational goals. Under the guidance of instructors, cadets can complete small electronic system design projects. Through these projects, cadets can apply their knowledge in a comprehensive manner, engaging in circuit design, simulation analysis, soldering, and debugging, which significantly enhances their practical and innovative abilities.

New knowledge is embedded within one or more tasks, and cadets are encouraged to analyze and discuss these tasks to identify the relevant areas of knowledge. This approach helps them systematically understand the knowledge structure and apply what they've learned to real-world scenarios. Projects stimulate cadets' interest in learning and encourage active participation in the learning process. During the course of learning, different cadets may adopt various approaches to complete tasks, promoting a deeper understanding of knowledge and its diverse applications. This process fosters cadets' self-directed learning abilities and innovation skills.

Furthermore, as cadets complete tasks, they must think critically about how to apply their knowledge to practical operations and problem-solving. This effectively deepens their understanding and memory of the material, facilitating the construction and internalization of knowledge.

(3) Blended Online and Offline Design

By introducing online discussion platforms, cadets are encouraged to actively engage in discussions before, during, and after class. Instructors can then adjust the course content and teaching methods based on the key topics of discussion and difficulties identified by the students. This method leverages both online resources and offline interactions to effectively organize and deliver the teaching content.

For online teaching, theoretical knowledge can be transformed into micro-lectures, PPTs, and text materials, which are uploaded to an online learning platform for cadets to access before or after class. In terms of learning resources, relevant reading materials, case studies, and online quizzes can be provided to help cadets reinforce and expand their knowledge. For interaction, an online discussion forum and Q&A sessions can be set up to encourage students to ask questions, share their learning experiences, and enhance interactive learning.

Offline teaching should focus on hands-on practice. For skills requiring practical application, offline classes should include operational training. Instructors can demonstrate and guide students through the practice process to ensure they master practical skills. For complex or highly discussed topics, small group discussions and case analyses can be organized to promote in-depth exploration, encouraging cadets to think critically and exchange ideas. Instructors should also provide timely feedback during class, addressing any uncertainties and offering personalized guidance.

Additionally, "in the context of the digital age, learning methods are undergoing profound changes, with fragmented learning becoming the norm" [2]. This shift in learning patterns has transformed teaching, learning, and assessment, as well as classroom structures and dynamics. Knowledge is now both transmitted and internalized within and beyond the classroom. Modern information technology has accelerated the dissemination of knowledge, providing diverse means of accessing it. The vast availability of knowledge through virtual networks allows students to easily search for information and engage in fragmented learning, greatly improving efficiency.

For electronic technology courses, the rapid development of virtual-real integration technologies has injected new vitality into teaching and broken away from traditional teaching models. Relying on these virtual-real platforms, teaching content can be reorganized. Remote virtual online course resources, 3D modeling and visualization, multimedia virtual simulation, circuit virtual simulation, and intelligent simulation technologies can be integrated to establish a new hybrid teaching model. This approach overcomes many of the limitations of real-world environments and motivates students to take a more active role in their learning.

3. Teaching Method Design Based on the Cadet Perspective

To enhance cadet engagement and classroom interactivity, it is essential to focus on personalized learning and individualized teaching methods that cater to the diverse learning needs of cadets. Sometimes, when cadets do not understand a concept in class, instructors may feel confused, wondering why a seemingly simple issue is unclear. This happens because instructors do not start from the cadet's learning foundation. From the cadet's perspective, certain concepts and theories that should have been explained were not, while the instructor subconsciously assumes that cadets have already mastered them. This reflects the difference between the instructor's perspective and the cadet's perspective.

The design of teaching methods for electronic technology courses, based on the cadet's perspective, should closely align with their learning needs and cognitive characteristics. The goal is to stimulate cadet interest, improve learning efficiency, and cultivate innovative thinking and practical skills. Emphasis should be placed on the effectiveness and practicality of hands-on teaching and project-driven learning, with careful consideration of the appropriate application of interdisciplinary teaching methods.

In the introduction of the class, engaging and practical cases should be used to immediately immerse cadets in an atmosphere where they are eager to acquire the knowledge and skills of the lesson. The introduction should smoothly transition to the first knowledge point of the lesson, and when necessary, ensure that adequate prior knowledge is supplemented and prepared for. The starting point of the cadets' learning should be the foundation for the design of the lesson content.

During the organization of teaching, customized learning or project-driven learning can be employed to meet the diverse learning needs of cadets.

(1) Interactive Teaching

Question-Driven Method: By posing questions closely related to the course content, cadets are guided to think and seek answers. This method can stimulate cadets' curiosity and desire for knowledge, encouraging them to actively engage in the learning process.

Group Discussions: Cadets are divided into groups to discuss and exchange ideas on specific problems or projects. Group discussions encourage the exchange of thoughts and viewpoints among cadets, fostering teamwork and communication skills.

Flipped Classroom: The traditional classroom lecture is shifted to pre-class learning through videos, reading materials, and other resources, while class time is mainly used for answering questions, in-depth discussions, and practical activities. The flipped classroom increases cadet self-study time and improves classroom efficiency. However, "there is no one-size-fits-all teaching model for every classroom" [3]. The flipped classroom, as a new teaching model, is also a teaching philosophy, and attention should be given to its frequency and context. The success of the flipped classroom largely depends on the instructor's guidance and organizational abilities. Overuse of this method may cause an imbalance, leading to the degradation of the instructor's role.

(2) Scenario Simulation and Case Analysis

Scenario Simulation: Simulating real electronic technology work environments or application scenarios allows cadets to learn and practice within the simulated context. Scenario simulations help cadets better understand the role and value of electronic technology in practical applications.

Case Analysis: Typical electronic technology cases are selected for analysis and discussion. Case analysis enables cadets to learn design concepts, implementation methods, and problem-solving strategies from specific examples.

(3) Integration of Practice and Experiments

Experimental Teaching: Increase the proportion of experimental courses, designing layered and challenging experimental projects. Experimental teaching allows cadets to operate electronic devices, observe experimental phenomena, verify theoretical knowledge, and improve practical and hands-on abilities.

Project-Based Learning: In course design, use projects as the main focus, allowing cadets to complete a small electronic system design project under the instructor’s guidance. Implementing multiple course project options allows cadets with different interests to explore their learning preferences, ultimately achieving mastery of knowledge and skills. Project-based learning helps cadets develop innovative thinking, teamwork, and problem-solving abilities.

(4) Application of Information Technology in Teaching

Multimedia Teaching: Use multimedia teaching tools such as PPTs, videos, and animations to present abstract electronic technology concepts in a more intuitive and vivid way. Multimedia teaching can enhance cadets' interest and improve their understanding.

Online Teaching Resources: Utilize online courses, electronic libraries, and technology forums as network resources, providing cadets with rich learning resources and communication platforms. Online teaching resources allow cadets to engage in self-directed learning and interactive exchanges anytime, anywhere.

(5) Personalized Teaching

Differentiated Instruction: Apply differentiated teaching strategies based on the learning foundations and abilities of different cadets. For cadets with weaker foundations, more tutoring and support can be provided; for cadets with stronger learning abilities, deeper study and research can be encouraged.

Self-Directed Learning Plans: Encourage cadets to create self-directed learning plans based on their interests and needs, under the guidance of instructors. These plans can be implemented before, during, and after class. Self-directed learning plans enable cadets to take a more active role in their learning, unleash their potential, and improve learning efficiency and self-learning abilities.

In the teaching practice of electronic technology courses, from the perspective of the cadets, we need to continuously explore and experiment with various teaching methods to build a more efficient, interactive, and productive learning environment. First, cadet participation is essential, and interactive teaching is key to stimulating their interest in learning and promoting deeper understanding. Through question-driven methods, group discussions, and flipped classrooms, we encourage cadets to actively participate and think critically, thereby deepening their understanding of electronic technology principles and applications through interaction. Second, scenario simulation and case analysis serve as bridges for cadets to apply theoretical knowledge to real-world problems. By simulating real work scenarios or analyzing specific cases, cadets can more intuitively appreciate the appeal of electronic technology while also developing problem-solving skills. Furthermore, the combination of practice and experiment is an indispensable part of electronic technology courses. Through hands-on experimental courses and project-based learning, cadets can not only consolidate theoretical knowledge but also enhance their hands-on skills and teamwork abilities, effectively linking the course content with engineering practice in the classroom. Additionally, the application of information technology in teaching brings new vitality to electronic technology courses. The introduction of multimedia teaching, online courses, and other resources makes learning more convenient and efficient, while also providing cadets with a broader learning space and communication platform. Lastly, the concept of personalized teaching runs throughout the entire teaching process. We respect each cadet's differences and uniqueness, and through differentiated instruction and self-directed learning plans, we strive to provide each cadet with the most suitable learning path and support.

4. Teaching Effectiveness Evaluation Based on the Cadet Perspective

The evaluation of teaching effectiveness in electronic technology courses from the cadet's perspective is a multidimensional and comprehensive process. Its aim is to fully understand cadets' satisfaction with the course, assess their learning outcomes, and identify existing problems to facilitate targeted improvements and optimizations.

(1) Cadet Satisfaction Evaluation

Content Satisfaction: Through surveys and interviews, gather cadets' feedback on their satisfaction with the course content. Evaluate whether the content is comprehensive and in-depth, whether it aligns closely with real-world work requirements, and whether it helps to enhance cadets' professional skills and practical abilities.

Method Satisfaction: Assess whether the teaching methods are diverse and flexible, and whether they effectively stimulate cadets' interest in learning and improve learning efficiency. This includes evaluating the application and effectiveness of interactive teaching, scenario simulation, and case analysis.

Resource Satisfaction: Evaluate cadets' satisfaction with the teaching materials, laboratory equipment, and online teaching resources. Determine whether the resources are rich, easy to use, and meet cadets' learning needs.

(2) Learning Outcome Evaluation

Knowledge Mastery: Through exams and quizzes, assess cadets' mastery of foundational knowledge and core skills in the electronic technology course. Evaluate whether cadets have met the course objectives.

Improvement in Practical Skills: Observe cadets' performance in experimental courses and project practices, assessing their improvement in hands-on abilities and problem-solving skills. The enhancement of practical skills is a key indicator of the effectiveness of teaching in electronic technology courses.

Cultivation of Innovative Thinking: Encourage cadets to participate in innovation projects and technology competitions, and evaluate whether their innovative thinking and abilities in the field of electronic technology have been fostered and developed.

(3) Problem Feedback and Improvement Suggestions

Problem Collection and Analysis: Collect and organize issues and shortcomings in the course through cadet feedback and teaching observations. These issues may involve content, methods, or resources.

Cause Analysis and Measures: Conduct in-depth analysis of the collected problems, identify their root causes, and then develop targeted improvement measures and optimization plans to enhance the quality and effectiveness of teaching.

Continuous Improvement and Optimization: Implement improvement measures and continuously monitor and evaluate their effectiveness. Based on the results, adjust and refine course content, teaching methods, and resources to better meet cadet needs and keep pace with developments in the field of electronic technology.

(4) Application of Evaluation Results

Guiding Course Improvement: Use the evaluation results as a key reference for course improvement. Address the identified issues and deficiencies with targeted changes and optimizations.

Motivating Instructor Development: Evaluation results provide insights into instructors' teaching levels and effectiveness. These results guide and support instructors' professional development. Understanding how cadet feedback and the use of teaching methods, resources, and technical support impact teaching outcomes is essential for improving teaching effectiveness.

Promoting Cadet Growth: Based on the evaluation results, provide cadets with personalized learning suggestions and guidance to help them better master electronic technology knowledge and skills, enhancing their professional competence and practical abilities.

The evaluation of teaching effectiveness based on the cadet perspective requires the establishment of a diversified assessment system, including regular grades, experimental performance, and project achievements. By employing various evaluation methods, cadets' learning outcomes and practical abilities are comprehensively assessed. During the teaching process, instructors should provide timely feedback to cadets, highlighting their strengths and weaknesses in learning and offering specific suggestions for improvement. Additionally, encouraging mutual communication and discussion among cadets promotes the sharing and deepening of knowledge.

5. Conclusion

In summary, the teaching methods for electronic technology courses should be a comprehensive combination of diversity, interactivity, practicality, and personalization. Therefore, the teaching model for these courses needs to fully consider the individualized needs of cadets. Conducting teaching activities from the cadet's perspective can effectively address the challenges of course teaching outcomes. Shifting away from the constraints of traditional teaching models, teaching should be organized with a cadet-centered approach. By providing diverse teaching resources and personalized learning pathways, the varying learning needs of cadets can be met.

Teaching based on the cadet's perspective aligns more closely with cadets' thinking and cognition, promoting the development of innovative thinking, practical abilities, and teamwork skills. Furthermore, the continuous advancement of educational technology provides strong support for teaching from the cadet's perspective. The application of modern educational technologies, such as multimedia teaching, online learning, and virtual simulation experiments, makes the teaching process more dynamic, intuitive, and convenient. These technological tools help stimulate cadets' interest in learning, improve learning efficiency, and offer more opportunities for self-directed learning and hands-on practice.

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