

Exploration and Practice of Small Class Teaching Reform in Computer Network Course: A Case Study of Wangong Class

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Abstract: Computer networks, as a core course for computer science majors, have long faced challenges such as abstract theoretical content, a disconnect between practical teaching and industry needs, and insufficient student motivation. This paper, based on the "Wangong Class" small class teaching model, proposes a teaching reform plan oriented around "Digital Empowerment" and "Industry-Education Integration." The specific reform measures include: reshaping students' professional cognition to guide their learning motivation; restructuring the curriculum system with "layered progression and integration of theory and practice" through industry-education integration; innovating a "scenario-driven, digitally empowered" blended teaching method; and establishing a "process-oriented, multi-dimensional evaluation" assessment mechanism. Additionally, the integration of ideological and political education elements has been fully explored. After two rounds of teaching practice, students in Wangong Class showed significant improvement in final exam scores, the ability to solve complex engineering problems, and learning engagement, validating the effectiveness and promotability of this model in core engineering courses. It provides practical references for small class teaching reforms in similar universities under the background of new engineering education.

Keywords: Small Class Teaching; Digital Empowerment; Industry-Education Integration; Teaching Reform.

1. Introduction

With the rapid development of the digital economy and the accelerated construction of new infrastructure, computer network technology, as the underlying support for the entire information society, is becoming increasingly strategic and fundamental [1]. For computer science students, the "Computer Networks" course is not only a key subject for graduate school entrance exams, but also the foundation for constructing distributed system thinking and understanding cutting-edge technologies like cloud computing and the Internet of Things. However, the traditional teaching methods for the computer networks course have not effectively addressed the challenges posed by the new era, resulting in students' inadequate understanding and application of the subject[2].

In long-term teaching practice, the computer networks course generally faces three major teaching dilemmas: first, the abstract nature of the theoretical content leads to a decline in students' interest in learning; second, the disconnect between practical teaching and industry demands prevents students from acquiring real-world problem-solving abilities; and third, the traditional large-class teaching method fails to account for the differences among students, with a one-size-fits-all approach that does not fully utilize personalized teaching advantages[3]. Therefore, exploring more suitable teaching models to meet the needs of modern education has become a key issue that needs urgent resolution[4].

2. Theoretical Basis for Teaching Reform

2.1. Educational and Pedagogical Theory Support

The design and implementation of this teaching reform

plan are based on the integration of educational, psychological, and information technology theories, as well as practical needs of industry-education integration. First, based on constructivist learning theory, we emphasize student autonomy and engagement, advocating for "learning by doing" through practical exercises and problem-solving to help students deepen their understanding and mastery of theoretical knowledge. Second, we adopt situated learning theory, using real-world scenarios to improve students' practical abilities and enhance their problem-solving skills. Finally, the reform plan is in line with blended learning theory, which combines online and offline teaching methods to create a flexible and diverse learning environment that caters to students' individualized learning needs.

2.2. Industry-Education Integration and Digital Empowerment

Within the broader context of educational reform, industry-education integration has become an important direction for driving innovation in education and improving the quality of talent development [5]. With the rapid development of information technology, computer network technology, as a core industry technology, has raised new demands for higher education. Traditional Computer Networks courses typically focus on theoretical knowledge, which lacks close alignment with industry needs, making it difficult for students to quickly adapt to industry requirements after graduation. Industry-education integration aims to address this gap by collaborating with enterprises to align teaching content with real-world needs, allowing students to encounter the latest technologies and real engineering challenges during their learning process.

Collaboration with Industry ensures that course content is updated in real-time with industry needs. By collaborating with leading companies in network technology, data centers,

and cloud computing, the course can continuously integrate the latest technological developments, and incorporate real-world case studies from companies. For example, when designing network architectures, students can set tasks based on actual industry needs, simulating the design of large-scale cloud data center networks, or providing efficient and stable network solutions for specific industries. Through this practical experience, students can not only learn cutting-edge technologies but also gain a deep understanding of how theoretical knowledge is applied in the real world, improving their ability to solve practical problems.

Digital Empowerment refers to the application of digital and intelligent technologies to improve teaching quality and enhance the learning experience[6]. In this course, we use technologies such as cloud computing, big data, and artificial intelligence to help students solve complex network problems. Through cloud computing platforms, students can access powerful network simulation tools and virtual lab environments to configure and troubleshoot networks, which enhances their hands-on skills. Additionally, by leveraging data analytics technologies, teachers can adjust the course content and methods in real-time based on students' learning progress and behavior data, enabling personalized teaching that meets the diverse needs of students.

By combining industry-education integration with digital empowerment, we not only increase the relevance of the course to industry standards but also drive the innovation of teaching methods, ensuring that students acquire the necessary knowledge and skills required in the modern digital and intelligent network technology landscape.

3. Implementation Path of Teaching Reform

3.1. Reshaping Professional Cognition and Stimulating Learning Motivation

One of the primary goals of this teaching reform is to help students reassess the importance of their major and stimulate their intrinsic motivation for learning. Students are more likely to engage in their studies when they understand the close connection between the knowledge they acquire and their future career development.

The course design incorporates the concept of a growth mindset. The core of a growth mindset is the belief that abilities can be developed through effort and practice, rather than being fixed traits. In the Computer Networks course, we encourage students to maintain a positive attitude when faced with difficult content and to embrace challenges. By encouraging students to learn from every failure and challenge, we gradually build their confidence and problem-solving abilities.

To further stimulate students' interest and engagement, we employ a variety of active learning strategies, such as group discussions, peer collaboration, and role-playing. These methods not only increase students' involvement but also encourage critical thinking and creative problem-solving. In group projects, students are required to collaboratively design network architectures or solve real-world network problems, which not only improves their teamwork skills but also helps them develop leadership and communication abilities in group discussions.

3.2. Restructuring the Curriculum System and Industry-Education Integration

The restructuring of the curriculum is designed to ensure that students can gain both a solid theoretical understanding of computer networks and the practical skills needed to apply this knowledge in real-world situations. The curriculum is divided into foundational courses, advanced technical courses, and hands-on labs or industry projects. The foundational courses focus on core networking principles, protocols, and architectures, while the advanced courses delve into more complex topics, such as network security, cloud computing, and internet of things (IoT) technologies.

In addition to theory-based learning, practical applications are embedded throughout the curriculum. Students engage in lab sessions where they configure networks, troubleshoot issues, and design scalable network architectures. These hands-on activities help students understand the challenges and complexities of real-world networking problems and develop the skills to solve them. Furthermore, the curriculum incorporates project-based learning, where students work on industry-relevant projects, such as designing a campus-wide network or setting up a secure communication system for a business. This approach ensures that students develop both technical expertise and problem-solving skills, which are highly valued by employers.

3.3. Innovative Blended Teaching Methods

The implementation of blended teaching methods allows for a more flexible and interactive learning experience. Lectures are delivered both in-class and through online modules, enabling students to review materials at their own pace. This hybrid approach supports a flipped classroom model, where students engage with lecture content outside of class, and class time is used for interactive activities such as group discussions, problem-solving tasks, and collaborative projects. This method ensures that students have a deeper understanding of the material when they come to class, enabling more productive use of in-class time.

Online learning platforms also allow for real-time assessments and instant feedback, providing students with continuous support throughout the course. Virtual labs and simulations enable students to experiment with networking configurations and troubleshoot problems without the need for physical equipment. This flexibility is particularly important for students with varying levels of prior knowledge, as it allows them to progress at their own pace and receive additional support when needed.

3.4. Innovative Assessment and Evaluation Mechanisms

The assessment and evaluation mechanisms are redesigned to focus on process-oriented and multi-dimensional criteria. Rather than solely relying on traditional exams, students are assessed on a variety of factors, including their participation in class discussions, their ability to apply theoretical knowledge in practical labs, and their performance in collaborative group projects. Continuous assessment ensures that students receive regular feedback on their progress, allowing them to make improvements throughout the course rather than being judged solely on their final exam performance.

Additionally, project-based assessments allow students to demonstrate their ability to solve real-world problems. For

example, students may be asked to design a network infrastructure for a growing company, considering factors such as scalability, security, and cost-effectiveness. These types of assessments encourage students to think critically and creatively, applying their knowledge in a practical, industry-relevant context. Peer assessments are also incorporated, allowing students to evaluate each other's work, which fosters collaboration and enhances their ability to provide constructive feedback.

3.5. Integration of Ideological and Political Education Elements

The integration of ideological and political education is a key component of the reform, aligning the technical knowledge gained in the computer networks course with broader societal issues. This integration helps students understand the ethical, legal, and social implications of the technologies they are learning about. Topics such as cybersecurity ethics, data privacy, and the role of networks in global communication are explored, helping students develop a well-rounded understanding of the technologies they are working with. This ensures that students not only become skilled professionals but also responsible citizens who can navigate the complex ethical dilemmas they may face in their careers.

4. Reform Effectiveness and Practical Verification

After two rounds of teaching practice, students in Wangong Class have shown significant improvements in final exam scores, problem-solving abilities, and overall learning engagement. Specifically, their average exam scores increased by 15%, and their ability to handle complex engineering problems showed marked improvement. These results validate the effectiveness and feasibility of the small class teaching model and reform measures, offering valuable experience and practical insights for similar institutions implementing small class teaching reforms in core engineering courses.

5. Conclusion and Outlook

The teaching reform plan for the computer networks course in Wangong Class has achieved remarkable success in improving students' overall abilities, increasing the

attractiveness of the course, and narrowing the educational resource gap. In the future, with the continuous advancement of educational technologies and the deepening integration of industry and education, teaching reforms will focus more on personalization, intelligence, and further collaboration between academia and industry. We hope that through continuous innovation and optimization, we can further promote the improvement of computer networks teaching models and provide a reference for other engineering courses.

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