Research and Practice on Project Driven Computer Network Security Teaching Model

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Abstract: This article aims to explore the research and practice of project-based computer network security teaching mode. With the rapid development of information technology, computer network security issues are becoming increasingly prominent, and the demand for network security talents is becoming increasingly urgent. The traditional teaching model of computer network security often focuses on imparting theoretical knowledge, while neglecting the cultivation of students' practical and problem-solving abilities. Therefore, this study proposes a project-based teaching model aimed at improving students' practical abilities in cybersecurity and cultivating cybersecurity talents with innovative and teamwork spirit through the implementation of practical projects. This study first analyzes the current situation and problems of computer network security teaching, points out the shortcomings of traditional teaching models, and elaborates on the advantages of project-based teaching models. Subsequently, this study designed a project-based teaching model and implementation strategies for computer network security. Through teaching practice, it was found that the project-based teaching model can significantly improve students' practical abilities in network security, enhance their understanding and application of network security knowledge.

1. Introduction

With the rapid development of information technology, computer network security issues have become increasingly prominent and have become one of the important issues that urgently need to be solved in today's society[1]. Computer network security is not only related to the protection of personal privacy, but also involves multiple aspects such as national security, social stability, and economic development[2]. Therefore, cultivating cybersecurity talents with high professional competence and practical abilities is of great significance for maintaining national information security and promoting social progress. However, the traditional teaching model of computer network security often focuses on imparting theoretical knowledge, lacking the cultivation of students' practical and problem-solving abilities. Therefore, it is necessary to explore a more effective teaching model to improve students' practical abilities in cybersecurity and cultivate cybersecurity talents with innovative and teamwork spirit. The project-based teaching model has emerged as a research hotspot in the field of computer network security education[3]. At the same time, the project-based teaching model can also promote the cultivation of students' teamwork spirit and innovation ability, laying a solid foundation for their future career development. This study aims to explore the research and practice of project-based computer network security teaching mode. By designing and implementing a project-based teaching plan, this study aims to enhance students' practical abilities in cybersecurity and cultivate cybersecurity talents with innovative and teamwork spirit.

2. The teaching status of computer network security

Currently, computer network security teaching has gradually been integrated into the higher education system, becoming one of the important courses in computer science and technology, information security and other related majors[4]. In terms of course offerings, most universities

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offer courses on computer network fundamentals, network security principles, cryptography, intrusion detection and defense, and network security management, covering the basic theories and practical skills of network security. However, there are still some problems in the actual teaching process. Firstly, the course content is not updated in a timely manner. Network security technology is advancing rapidly, with new attack methods and security vulnerabilities emerging one after another. However, some textbooks and teaching content have not been followed up in a timely manner, resulting in students learning knowledge that lags behind actual security needs. Secondly, there is a disconnect between theory and practice. Network security is a highly practical discipline, but some universities place too much emphasis on theoretical teaching and lack sufficient practical links in the teaching process, making it difficult for students to translate theoretical knowledge into practical operational abilities.

In addition, there is insufficient interdisciplinary integration. Network security issues often involve multiple disciplines, such as computer science, mathematics, law, etc. However, in practical teaching, the integration between these disciplines is insufficient, making it difficult to form a comprehensive and systematic knowledge system. In terms of teaching methods, most universities still adopt traditional lecture style teaching. Although this method can systematically impart knowledge, it lacks interactivity and innovation, making it difficult to stimulate students' interest and initiative in learning. In recent years, some universities have begun to introduce teaching methods such as case-based teaching and project-based learning. By simulating real security events and scenarios, students can learn and master network security skills in practice, achieving certain results[5]. In terms of teaching methods, with the advancement of information technology, modern teaching methods such as multimedia teaching and online teaching have been widely applied. These methods enrich the teaching content and form, and improve the teaching effectiveness. However, there are also some problems, such as some teachers not being proficient enough in the use of modern teaching methods, making it difficult to fully leverage their advantages; At the same time, the quality of online teaching resources varies and needs further improvement and standardization.

3. The theoretical basis of project-based teaching mode

3.1. Constructivist learning theory

Constructivist learning theory is one of the important theoretical foundations of project-based teaching mode. This theory holds that learning is not simply the transfer of knowledge, but rather the process of learners actively constructing new knowledge and understanding through interaction with the external environment based on their existing knowledge and experience. In project driven teaching mode, students are placed in specific project contexts to construct and deepen their understanding of network security knowledge by solving practical problems. This process emphasizes the initiative and participation of students, encouraging them to complete project tasks through exploration, cooperation, and innovation, thereby achieving active construction of knowledge.

3.2. Pragmatist educational theory

The pragmatic educational theory also provides theoretical support for project-based teaching models. Pragmatism education emphasizes that education should be closely linked to real life, focusing on cultivating students' practical and problem-solving abilities. In project driven teaching mode, students combine their knowledge with real-life network security issues by participating in practical projects, and solve problems through practical operations. This teaching model not only helps to improve students' practical abilities, but also enables them to better understand and apply the knowledge they have learned, achieving the transformation of knowledge and skills.

3.3. Theory of developing problem solving abilities

The theory of cultivating problem-solving ability suggests that by solving practical problems, students can develop critical thinking, innovation, and problem-solving abilities. In project driven

teaching mode, students are faced with real network security problems or simulated practical scenarios, and they need to use their learned knowledge to analyze, judge, make decisions, and operate in order to solve problems. This process helps to cultivate students' problem-solving abilities, enabling them to better cope with complex situations that may arise in future work.

4. Construction of a project driven computer network security teaching model

4.1. The principles and objectives of constructing teaching models

The construction of a project-based computer network security teaching model should follow the principles of student-centered, practice oriented, problem-solving combined with knowledge construction[6]. This model aims to combine theoretical knowledge with practical operations through a project driven approach, cultivating students' network security practical ability, innovation ability, and teamwork spirit. The specific goals include: improving students' awareness and skill level of network security; Cultivate students' ability to solve practical network security problems; Promote the cultivation of students' habits of self-directed learning and lifelong learning.

4.2. The constituent elements of teaching mode

The project-based computer network security teaching model mainly consists of integrated elements, which cover multiple aspects such as project design, student grouping and role allocation, teacher roles and guidance, learning resources and environment, and evaluation and feedback mechanisms[7]. In this teaching model, project design serves as the core and closely integrates with the practical needs of the field of network security, aiming to enable students to fully understand and master network security knowledge. Students are grouped according to project requirements and play different roles to simulate the real environment of network security work, cultivate teamwork and communication skills. Teachers play the role of guides and supporters throughout the entire process, providing necessary guidance and technical support to students. At the same time, the abundant learning resources and professional experimental environment provide students with a platform for independent learning and a place for practical operation. Finally, through a scientific evaluation and feedback mechanism, teachers can timely understand the learning situation and existing problems of students, and provide targeted feedback and guidance to ensure teaching quality and student learning outcomes. This teaching model not only enhances students' practical and problem-solving abilities, but also cultivates their innovative consciousness and teamwork spirit. Meanwhile, through effective guidance and timely feedback from teachers, students can continuously adjust their learning strategies and optimize their learning methods during the project implementation process, thereby better achieving their learning goals. This project-based teaching model is of great significance for cultivating cybersecurity talents who can adapt to the needs of social development.

4.3. Innovation points of teaching mode

The innovation of project-driven computer network security teaching mode is significant, and its most prominent feature is to strengthen the practical aspect, encourage students to transform theoretical knowledge into practical operational ability, and effectively improve their network security practical ability[8]. This model focuses on problem solving and is guided by solving practical problems. It enables students to flexibly apply their knowledge when facing real challenges, and develops their problem solving ability and critical thinking. At the same time, this model is also committed to promoting student knowledge construction, encouraging students to actively construct and deepen their understanding of cybersecurity knowledge through exploration, cooperation, and innovation during project implementation, thereby cultivating their ability for self-directed and lifelong learning.

4.4. Evaluation of the effectiveness of teaching mode implementation

The evaluation of the effectiveness of teaching mode implementation is a key link in ensuring teaching quality. Through comprehensive assessment of student project completion quality,

practical operation ability, teamwork and innovation ability, the implementation effect of project-based computer network security teaching mode can be comprehensively evaluated. The evaluation of the implementation effect of the teaching mode is shown in Table 1.

Table 1 Evaluation of the implementation effect of teaching mode

Evaluation indicators	Describe	Evaluation methods
Student satisfaction with project-based teaching mode	The level of acceptance and interest of students towards the teaching mode, as well as the degree to which they believe the mode is helpful for learning	Questionnaire survey and interview
Improvement of Students' Practical Ability in Network Security	The skill level and problem-solving ability demonstrated by students in project implementation	Project achievement evaluation and practical operation examination
Improvement of student teamwork and communication skills	The collaboration, communication, and role-playing abilities of students in project teams	Team evaluation and teacher observation
Student's mastery of network security knowledge	The level of mastery of basic knowledge and application skills of network security by students	Knowledge testing and case analysis

5. Implementation strategy of project driven computer network security teaching model

5.1. Project design and grouping strategy optimization

When implementing a project-based computer network security teaching model, this study first focuses on the design of projects and the optimization of grouping strategies. The project design should ensure authenticity and challenge, closely combine with the actual needs of the industry, and cultivate students' practical operational abilities. Meanwhile, the grouping strategy should focus on the interests and abilities of students, ensuring complementarity and collaboration among team members.

5.2. Strengthening the practical process and resource construction

The practical stage is the core part of the teaching mode, and this study is committed to strengthening the practical stage and resource construction. By providing advanced experimental equipment and software, as well as abundant learning resources, this study has created a favorable learning environment for students. In addition, this study also carries out diverse practical activities, such as attack and defense drills, safety competitions, etc., to enable students to exercise their skills and improve their overall quality in practice.

5.3. Improvement of evaluation and feedback system

Evaluation and feedback are crucial steps in ensuring teaching quality. This study established a comprehensive evaluation and feedback system, which comprehensively evaluates students' learning outcomes and progress through diversified evaluation methods. At the same time, this study focuses on process evaluation, paying attention to the performance and progress of students in the project implementation process, and providing them with timely feedback and guidance. In addition, this study also established a feedback mechanism to regularly communicate with students, understand their learning needs and difficulties, in order to adjust teaching strategies and methods in a timely manner.

The effective implementation of project driven computer network security teaching mode strategy not only improves students' practical ability and comprehensive quality in network security, but also provides strong support for cultivating high-quality network security talents. The key points of the implementation strategy of project-based computer network security teaching mode are shown in Table 2.

Table 2 Key points of implementation strategy for project-based computer network security teaching mode

Key points	Implementation content
Project design and grouping strategy optimization	Design realistic and challenging projects that meet the actual needs of the industry. Group students based on their interests and abilities to promote teamwork and communication
Strengthening the practical process and resource construction	Provide advanced experimental equipment and software to create a good learning environment. Integrate rich learning resources, including online courses, case studies, etc
Improvement of evaluation and feedback system	Establish a diversified evaluation system to comprehensively evaluate student learning outcomes. Establish a feedback mechanism, regularly communicate with students, and adjust teaching strategies and methods

6. Conclusions

This study delves into a project-based teaching model for computer network security and puts it into practice. With the rapid development of information technology, network security issues have become increasingly prominent, and the demand for high-quality network security talents has become increasingly urgent. The traditional teaching mode of computer network security is no longer able to meet practical needs, therefore, exploring and practicing a new teaching mode is particularly crucial. This study proposes a project-based teaching model to address the shortcomings of traditional network security teaching methods, and verifies its effectiveness through teaching practice. The project-based teaching model not only significantly improves students' practical abilities in network security, but also enhances their understanding and application of network security knowledge. During the project implementation process, students are able to actively explore and solve problems, cultivating innovative and teamwork spirit. Meanwhile, this study also found that project-based teaching models can help stimulate students' learning interest and enthusiasm, promote teacher-student interaction, and improve teaching quality. During the process of participating in projects, students can personally experience the complexity and challenges of network security issues, thereby gaining a deeper understanding of network security knowledge and improving practical abilities. The project-driven teaching model for computer network security is an effective teaching model that can overcome the shortcomings of traditional teaching methods, cultivate students' practical abilities, innovative spirit, and teamwork spirit. This study provides new ideas and directions for teaching computer network security, which is of great significance for cultivating high-quality network security talents and promoting the development of the field of network security.

References

[1] Pascal R, Weihl C. Setting the Stage: Welding in the Film and Television Industry[J].Welding Journal, 2018, 2018 (10):97.

[2] Wang W, Mandal D. Research on the construction of teaching platform of drama film and television literature based on IoT[J]. Journal of Intelligent and Fuzzy Systems, 2019, 37(4):1-8.

[3] Eli A, Hüseyin Yaratan, Abubakar A M. Multidimensional Faculty Professional Development in Teaching and Learning: Utilizing Technology for Supporting Students[J].International Journal of Technology-Enabled Student Support Services, 2020, 10(1):21-39.

[4] Stezhko N G. Features and specificity of creating a script for a television documentary drama[J].Proceedings of the National Academy of Sciences of Belarus Humanitarian Series, 2020, 65(3):328-335.

[5] Zhang L. Development Opportunities and Challenges of Film and Television Industry in the Post-Epidemic Era[J].Journal of Economic Management: Chinese and English versions, 2022, 11(2):48-53.

[6] Hill J.Television Drama and Northern Ireland: The First Plays[J].Journal of British Cinema and Television, 2023, 20(3):279-304.

[7] Liang Yaogeng, Chen Yang. Exploration of Teaching Strategies for Dramatic Film and Television Performance Practice under Multidimensional Thinking [J]. Grand View: Forum, 2022, 2022 (9): 99-101.

[8] Wang Yaohua. Analysis of Teaching Strategies for Dramatic Film and Television Performance under Multidimensional Thinking [J]. Huaxi, 2018, 2018 (30): 146-147.