

## Construction and Practice of Excellent Course of "Network Security Technology"

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**Abstract.** Through the investigation and analysis of advanced applied talents in network security, developed and implemented the in-depth and optimized construction plan for the "Network Security Technology" excellent course of Shanghai colleges and universities. Reform and practice are conducted on course construction orientation, characteristics, system architecture, teaching contents, teaching mode, teaching and assessment methods, resources and the base of industrial-academic-research, achieved a lot of results.

### Introduction

In China, the "National medium and long-term education reform and development plan (2010-2020)" defined the guiding ideology of education reform and development, and put forward the principle of "Giving priority to developing, educating people, reforming and innovating, promoting fairness and improving quality ". In December 27, 2016, the national Internet information office first released the "National cyberspace security strategy", clarified the importance and development strategy of China's cyberspace, and played a significant role in guiding the cultivation of advanced talents in network security [1].

With the rapid development and extensive application of network technology, network security has become the focus of attention, the importance of network security is more prominent, it relates to national security, social stability and the safety of information resources of various users, has become a new hot field of research and talent requirement. In order to adapt to the modern information construction to ensure the safe operation of the network system, it is urgent to cultivate a large number of advanced applied talents who have mastered the network security technology. The construction of the curriculum is the key to the cultivation of talents. On the basis of the research project of "industry-academic cooperation on people education" funded by the Ministry of Education of China and the construction of excellent courses of Shanghai universities, we have carried out the "network security technology" curriculum deepening construction plan, reform and research after investigation and analysis. By drawing on advanced technology, methods and applications from abroad, we should establish curriculum teaching objectives based on social needs, and reform the structure, teaching content, teaching mode, teaching and assessment methods and teaching resources that are suitable for our network security technology curriculum characteristics.

### Demand analysis of network security talents

The strategic goal of China's information development in year 2020 is basically universal access to information infrastructure, the level of national information security has been greatly improved, and national economy and social informatization. Among them, the security of information construction and application, the development of the information security industry are in urgent need of a large number of advanced applied talents in network security [1].

Now, according to the statistics of the "Network security talent market research report" released by 360 Internet Security Center and Zhaopin, the important industry in China requires all kinds of network security talents a total of about 700 thousand and is expected to reach 1 million 400

thousand by 2020, the under-graduates accounted for 56.6%, applied talent accounted for about 76%. In the first half of 2017, the recruitment demand for network security posted through Zhaopin was 232% higher than the same year in the first half of 2016. The lag of talent cultivation, which has become the "bottleneck" and key elements of China's information construction and the healthy development of network security industry and network system in the development, management, technology and other aspects of the development, but also seriously affected the healthy development of China's economy, and the relevant industry international competitiveness [2].

The main demand of enterprises and institutions are advanced applied talents with "institutions quick, strong ability", the key universities cultivate research oriented talents, and the traditional mode of teaching professionals in colleges and universities, emphasizing theory and research, neglecting practice, emphasizing the cultivation of knowledge and skills and neglecting the cultivation of quality and ability, ignores the new application of new technologies and pertinence, and the knowledge update lags behind and leads to the knowledge learned Incompatible with the actual needs, resulting in the phenomenon of having high ambition but no real ability. Therefore, to reform the cultivation mode of network security advanced applied talents and accelerate the cultivation of high-quality, internationalized, compound application, innovative and sustainable network security advanced applied talents is very important [3].

### **Knowledge quality requirements and teaching objectives**

**Requirements for the quality and ability of professional talents.** To improve the quality of advanced applied talents in network security, need to pay attention to the comprehensive cultivation of the ability of knowledge quality. Based on the foreign advanced education concept for advanced applied talents, the requirements of knowledge and quality of talents are established according to social needs. Engaged in the occupation mainly include: information technology departments in enterprises and institutions, engaged in related network security management and technical work, to ensure the safe operation of the network system and data security; information related to the application of network resources and service related departments or positions in the specific business information processing, safety management, and application in the process of service maintenance and service; Network security engineering and product development departments involved in network security products analysis, design and implementation, debugging and testing, operation and maintenance, sales training and other related positions; All relevant departments or positions involved in network security and reliability research and maintenance. The main employment directions are: network security engineer, network security administrator, network engineer or network administrator or network inspector with network security responsibility, network security engineering appraisers, analysts, designers, programmers, test engineers, supervisor of network security products sales promotion, training and other aspects [4].

In order to better adapt to the needs of the society and pay attention to the requirements and cultivation of the knowledge quality ability of the advanced applied talents in network security, the key points include three aspects: Basic knowledge and quality ability, professional knowledge and quality ability, comprehensive knowledge and quality ability. Basic knowledge of quality and ability includes: morality, body, labor and other comprehensive development required for the basic knowledge of quality and ability, the need to focus on the cultivation of teaching and practice training and basic legal ethics culture and sports etc.; Professional knowledge and comprehensive ability, mainly focus on the cultivation of students' ability of quality, network security management and technical aspects include: understanding and update, management and service, analysis, design, operation, application, innovation and teamwork, mainly including "six abilities": the network security management and technical aspects of the basic application ability; development of network security products and application of actual operation ability; network security technology, management and operation ability; network security information construction and database security assurance ability; network security and maintenance ability; comprehensive application, service, innovation and team cooperation ability and so on [2,4].

**The goal and characteristic of curriculum construction.** Through the in-depth optimization, the course teaching objectives are determined. With the rapid development and wide application of information technology, the global "digital economy" and the integration of electronic transactions have been formed. In order to adapt to the needs of the society for network security technology, pay attention to the cultivation of knowledge, quality and ability of network security, high technology and practical technology, and achieve the requirement of high quality online curriculum of Shanghai universities and ISO standard. Pay attention to the basic theories and implementation techniques of "attack, prevention, detection, control, management, evaluation" and so on. Pay more attention to the combination of laws and regulations and moral education, network security management and network security technology, and further strengthen the cultivation of talent quality and ability and the quality of course teaching. It enables students to acquire solid knowledge, technology, methods and applications, and combine them with practical business analysis, resolution, application ability and awareness of innovation and entrepreneurship [5].

Highlight the characteristics of cultivating the applied talent with excellent technology. Through the optimization of curriculum knowledge system, forming a "five outstanding" (practical, characteristic, course quality, talent quality, ability), "six combination" (theory and practice, full time and part-time teachers, classroom teaching and extracurricular practice, imparting knowledge and cultivating ability, industrial-academic-research cooperation, curriculum construction and discipline connotation construction) and "integration of teaching, learning, practice, do, use" teaching mode, knowledge ability reaches reality, practice, practical, with broad knowledge, broad ability and broad employment, overall quality, first-class teaching team, first-class teaching content, first-class national planning materials and the best teaching methods, first-class teaching achievements.

### **Deepening the curriculum reform and practice**

Through the deepening of the curriculum construction and practice, awarded two the Ministry of education research projects, three "13th Five-Year" national key publishing planning project, Shanghai college and university excellent course had been further upgraded and had broader influence, won several awards.

**Deepen the reform of the teaching system and content of the course and the construction of the teaching materials.** According to the curriculum construction objective, through revising the teaching syllabus, constructing a new teaching system, edited "cubialization and new form" national planning teaching materials, synchronous experiment and comprehensive practice, the application of case and animation simulation software, MOOC, PPT and online testing and answering. Edited Shanghai excellent course teaching material "network security technology and application", etc., total 6 books won the outstanding teaching material award of Shanghai colleges and universities. Several times has been invited to provide online train to national teachers, lecture and introduce experience and publish papers domestic and abroad [6].

**The reform of teaching mode is optimized.** Implementation of "appliance, characteristics, specification, quality" and ISO curriculum standards, the formation of the "five outstanding", "six combination" and integration of "teaching, learning, practice, do, use" open teaching mode, in order to adapt to the development of the network security needs of modern information and network application and modern service industry and pay attention to the student as the main body, the teacher as the leading, the training as the main line, to increase the practice of simulation security training and occupation certificate "network security" training.

**Pay more attention to the reform of teaching methods.** In the process of teaching theory and practice, adopted "Simulation enterprise project promotion method", "eight double teaching method" (double plan, double syllabus, double teaching material, double teaching case, double teaching method, double practice, double homework, double examination), case teaching and multimedia animation simulation of modern information "cloud classes" teaching methods, combined with the new technology of mobile wireless network security, new generation IPv6 network security, virtual LAN security, intelligent defense and application in practice teaching, practice and discussion

groups, the use of advanced technology to improve students' comprehensive quality and ability [7].

**Continue to strengthen the construction of the teaching team.** With the university strengthen the connotation construction, have young teachers trained in enterprise, guidance and encouragement for further study, visiting exchange scholars domestic and abroad and MOOC team, implement the cultivation plan and implementation plan, the curriculum and teaching material construction improve with the time, to promote team building. Invited by Education Center of Institute of computing of the Chinese Academy of Sciences to lecture for the "Network Security Advanced Study Seminar". In recent years, several people study and exchange abroad or domestic enterprise exercise. Won the 2017 annual Shanghai top-ten charm teachers and prize.

**Construction of network three-dimensional teaching resources.** Make full use of the MOOC cloud class network resource and mobile interaction and information sharing, extension of extracurricular teaching, the introduction of online teaching community. The use of network classroom and animation to stimulate interest in learning, optimization of multimedia teaching resources, improve the online counseling, answering questions, forums and other functions, so that teachers and students can also fully communicate outside the classroom, the Shanghai colleges and universities excellent course website is very popular hits 180 thousand times. Also provides mobile phone cloud class resources, superstar MOOC resources and stereoscopic network resources.

**A new method of assessment and evaluation is carried out.** Scientific assessment on the learning whole process all aspects, including the assessment of all aspects of learning in the learning process (tests include practical and applied questions), learning attitude, participate in projects and activities, classroom discussion, homework, experiment, curriculum design, teamwork, innovation activities. Evaluation methods flexible, pay attention to the combination of the assessment of the practical ability and the written examination, at the same time off campus practice tasks (such as research, technology and other operations) completion assessment, intensify the assessment of practical ability. Provided guidance to five Shanghai college student innovation projects, students received eleven national and city level awards, three national patents, published two papers.

**Strengthen the practice teaching conditions and practice base construction.** Based on the original 11 industrial-academic-research bases, improve the cooperation between colleges and enterprises, such as the Third Research Institute of the Ministry of public security, Shanghai ZTE communication technology limited joint teaching and laboratory and research cooperation, to further strengthen and improve the practice teaching conditions and practice base construction, to further strengthen the "come in and go out" practice teaching.

**Standardize the course management and document construction.** According to the curriculum construction and the ISO specification, revision and improvement of the course syllabus, lesson plans, courseware, video, test paper library, practice exercises, experimental instruction, experiment report, curriculum design guide book and report, course construction management and documentation standards and standardized construction.

## **Conclusion**

According to the social needs and talent cultivation objectives, the quality and ability cultivation as the main line, insist on using a combination of industrial-academic-research-application, strengthen the application and the practice, pay attention to the quality and ability cultivation, through the "network security technology" curriculum reform and practice, further optimization of the construction, and comprehensive exploration the curriculum system, teaching contents, teaching materials, teaching mode and method, curriculum evaluation feedback and other aspects, and achieved good teaching effect and rich research achievements, upgrade the excellent course of Shanghai colleges and universities to the "high quality online course" to improve the level of construction and have a greater increase in the country influence, also realize the cultivation goal of advanced applied talents in network security.

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