Training of Outstanding Talents in Cyberspace Security under the Background of Digital Intelligence

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Abstract. Under the background of the era of digital intelligence, it is more necessary to integrate the discipline of cyberspace security into the new era and actively explore the cultivation path of digital intelligence talents. Research on the cultivation of cyberspace security digital intellectual talents from cognition to application, clarify the education system, focus on describing the core literacy of talents based on the OBE concept, build a diversified talent cultivation path, show the characteristics and wisdom of cyberspace security discipline education, and constantly improve and enrich the connotation of outstanding talents in cyberspace security in teaching practice. The research results have important practical significance for safe China and the construction of cyberpower.

Keywords: OEB; excellence; practice system; network security.

1   Introduction

At present, digital intelligence empowers new quality productivity and is also one of the challenges of economic and social development. High-tech abuse incidents in cybercrime emerge in an endless stream. Generative artificial intelligence technology provides new technical tools for criminals and becomes a "new weapon" of fraud activities. Problems such as personal information leakage, information fraud, and critical information infrastructure attacks continue to be prominent. Cyberspace security talents are an important guarantee for the development and construction of cyberpower. Cultivating high-quality and innovative high-level cybersecurity talents that meet the needs of national strategy and industry needs is the historical mission and responsibility of China's higher education in the new era. Therefore, under the trend of digital intelligence, the original teaching ideas, teaching methods, teaching content and teaching evaluation of the discipline construction of cyberspace security in colleges and universities need to make corresponding changes.

2   The Essence of Digital Intelligence

Digitalization has become a key force to reorganize global factor resources, reshape the global economic structure, and change the international competition pattern. With the

increasing development and wide application of Internet, big data, artificial intelligence and other technologies, the new model of "digital intelligence" with the connotation of "digitalization + intelligence" is rapidly rising[1]. The essence of digital intelligence is to realize intelligence through digitalization. First, with the help of big data, cloud computing, artificial intelligence and other technologies, the system has the ability to realize state perception, real-time analysis, scientific decision-making and accurate execution. Second, by means of digital simulation of human intelligence, let intelligence digital, and then applied to system decision-making and operations[2]. At present, more is the fusion of data and intelligence to promote the intelligent generation of the system.

Talent, mechanism and carrier are important components of digital ecology[3-4]. The 2022 National Conference on Education Work proposed to implement the strategic action of education digitalization, requiring to strengthen demand traction and accelerate the digital transformation and intelligent upgrading of education[5]. Nowadays, big data, artificial intelligence, mobile Internet, cloud computing and Internet of things are integrated and innovated in all walks of life. The continuous explosion of new formats has promoted the evolution of traditional occupations, and new jobs have also emerged[6].

3   Challenges and Opportunities of Digital Intelligence for the Training of Cyberspace Security Talents

At present, the network security situation is serious, network attacks occur frequently, large hacker organizations frequently attack critical information infrastructure networks, steal sensitive data through DDoS attacks, system vulnerabilities, phishing fraud, ransomware and other ways, and endanger national security, social stability and people's life and property safety. In particular, it has ushered in new risks in privacy protection and data security. For example, the use of artificial intelligence technology, two-dimensional code and other phishing attacks cause user information leakage. The use of niche programming languages with few security analysis tools to develop malware has caused the rapid spread of ransomware[7].

At present, although colleges and universities in China have accumulated some experience in the training of network security talents, on the whole, the traditional talent training system cannot meet the needs of the cyberspace security innovation talent training in the era of digital intelligence. There are many shortcomings in terms of course teaching and practice system, which are mainly reflected as follows:

(1)The teaching content of the course is strong knowledge, and the content of the change in the era of digital intelligence is insufficient.

(2)The teaching mode has more theoretical explanations, and the innovative teaching inspired by cases still needs to be strengthened.

(3)The integration of production and education and collaborative education are immature, and the teaching resource platform is still weak.

Therefore, the training of innovative talents in cyberspace security under the background of digital intelligence needs to adapt to the needs of The Times, and innovate and reform the theoretical and practical teaching system.

4   Overview of OBE Concept

OBE(Outcome-Based Education) was first proposed in 1981, which has formed a relatively complete set of theoretical system and implementation mode, and has been widely adopted in education developed countries such as the United States and Canada[8]. The concept advocates outcome-based education, integrating the social needs and goal orientation of talent training into the whole process of talent training, constantly improving in teaching practice, and enriching the connotation and essence of talent training. OBE emphasizes that the goal of teaching design and teaching implementation is the final learning results achieved by students through the education process, and evaluates the effectiveness of professional education against the core capabilities and requirements of graduates, and determines the teaching activities from the final results[9]. The concept involves three key steps of defining learning outcomes, realizing learning outcomes and evaluating learning outcomes, and the main purpose is to answer the following questions in the process of talent training[10].

(1)Objective: What learning outcomes should students receive.

(2)Need: Why students should get these learning outcomes.

(3)Process: How to help students achieve these learning outcomes.

(4)Evaluation: Whether students get these learning outcomes.

(5)Improvement: What should students do if they do not get these learning outcomes.

The training of innovative talents in cyberspace security under the background of digital intelligence needs to adapt to the needs of The Times, and innovate and reform in terms of theoretical and practical teaching system. The OBE education concept of student-centered, outcomes-oriented, and continuous improvement, combined with the training of innovative talents in cyberspace under the background of digital intelligence, has natural advantages in creating high-level superior majors.

5   The Cultivation of Innovative Talents in Cyberspace Security Subject under the concept of OBE

According to the OBE concept, the design of talent training program for cyberspace security discipline starts from the practice of cyberspace security, focuses on the social demand for cyberspace security professionals, scientifically determines the training objectives, carefully develops the graduation requirements, improves the professional teaching mode, and continues to do a good job in evaluation and feedback improvement. as shown in the figure 1.

5.1   Scientific Determination of Training Objectives

The first answer to the cyberspace security innovative talent training program under the OBE concept is what learning outcomes students should get. Why students should get these learning outcomes[11]. Here, in accordance with the needs of the national network security strategy, network security requirements and new engineering construction re-

quirements, a wide range of needs research has been carried out, by issuing question-naires, organizing seminars, field interviews, third-party research and other forms to fully understand the needs of all parties. Actively integrate into the national "Six Excellence and One Top" plan 2.0.According to the reform concept of the Excellent Engineer Talent Education and Training Plan 2.0 talent training mode, with the purpose of serving the national security strategy and the demand for talents in the construction of a higher level of the Peaceful China initiative., combined with the school positioning and professional construction characteristics, the training goal of innovative talents in cyberspace security is scientifically determined. It highlights the cultivation of core competencies in cyberspace security governance, cyber attack and defense technology, and the application of cryptography technology, and cultivates innovative high-quality cybersecurity talents who meet the requirements of the national construction of a comprehensive cybersecurity prevention and control system, are proficient in cyberspace governance concepts, and have cryptography knowledge and cybersecurity technology.
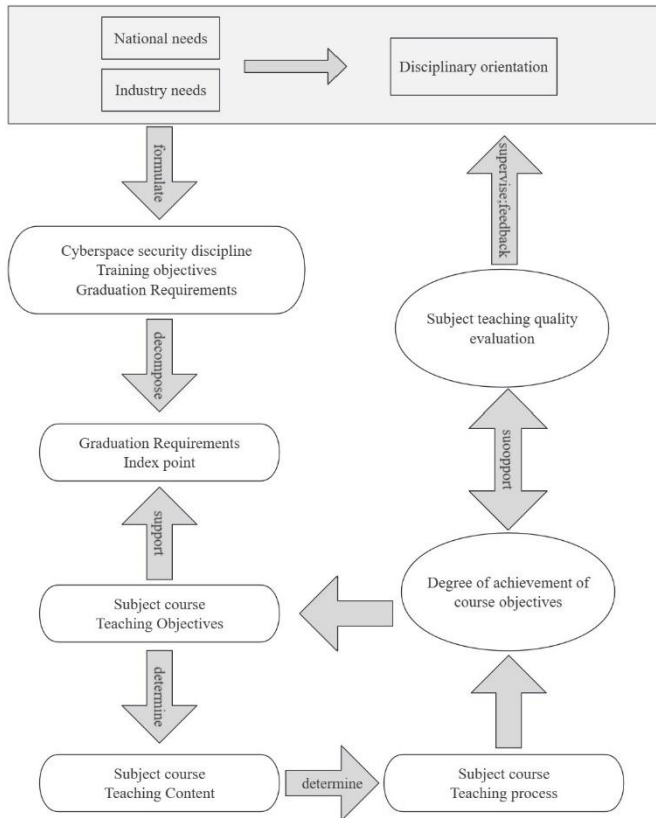
Fig. 1. Cultivation program design

5.2   Carefully Develop Graduation Requirements

The professional certification of engineering education clearly points out that graduation requirements refer to the level that students can achieve when they graduate, including knowledge, ability and quality. According to the training objectives, compared with the national standards of cyberspace security discipline, the requirements of new engineering construction and professional certification standards, the graduation requirements of postgraduate students in cyberspace security discipline are scientifically prepared. It highlights the needs of new technologies, new concepts and new actual combat to adapt to the needs of network security work in the era of digital intelligence, has the consciousness and ability of innovation, has the ability of big data analysis and mining, and can use data technology and AI technology to conduct in-depth analysis of network security incidents.

5.3   Highlight the Digital Intelligence Technology, Reform the Course Teaching Content

In the course teaching, the introduction of cutting-edge scientific and technological achievements into the course is advocated. In the core courses, the cutting-edge scientific and technological trends in the field of network security are tracked in time, and the latest scientific and technological achievements are introduced into classroom teaching. The teaching process adopts small class teaching mode, gives full play to the role of laboratory and simulation platform, carries out network attack and defense drill, realizes the organic combination of "learning" knowledge and "training" skills, and improves the actual combat ability. Guided by network security competition and actual combat ability, the combination of special training and autonomous learning is implemented, and real combat experts and enterprise lecturers are invited regularly or before the competition for special training and competition review and discussion to improve practical technical ability.

Diversified course assessment methods were adopted to adapt to the characteristics of rapid update of new technology and new knowledge and strong practicality of the curriculum under the background of digital intelligence. Adopt the way of "certificate for class, competition for class"; For the professional limited courses, it pays attention to the process assessment, and focuses on the thematic practice assessment.

5.4   Multi-measures, Multi-forms to Strengthen the Actual Combat Skills to Strengthen Training

(1)Formulate a systematic practical training system and carry out diversified practical activities. Formulate a systematic practical training system and carry out diversified practical activities. Starting from the learning cycle, according to the logic of professional knowledge construction, two teaching systems are formulated. The first is the professional teaching practice system of "in-class teaching training, curriculum comprehensive experiment, special exercise, professional practice, graduation design" from

shallow to deep. Second, the extracurricular practice system of "intra-school group, inter-school exchange, special competition and comprehensive competition" step by step. In stages and steps, students are arranged to cooperate with public security organs, Cyberspace Administration and other departments to participate in special actions such as network protection operations and attack and defense drills, so as to improve students 'actual combat ability of network security.

(2)Build an advanced training platform and establish a strict training management system. In the construction of professional teaching resources, simulation of the real network environment, in order to buy services or try to rent, and signing network security enterprises on the training of outstanding talents in-depth cooperation, the introduction of the latest network security equipment and software, or the use of cooperation platform, enterprise resources advantage, Provide students with online learning, advanced training, actual combat observation and other conditions. The attack and defense actual combat drill platform is constructed, and the simulation drill and in-depth analysis are carried out combined with real cases. Conditional implementation of the all-weather laboratory open system, open professional network security foundation, electronic data inspection and identification, professional comprehensive drill laboratory, for students to make science and technology, competition training, independent learning and discussion of open laboratory resources. The whole training process was monitored and guided to ensure the quality and effect of training.

(3)Strengthen school-enterprise cooperation and school-bureau cooperation, and implement professional "double tutors". Give full play to the advantages of school-bureau cooperation, introduce grass-roots actual instructors to participate in the course teaching practice, adopt the "double tutor" system, and equip each student with one internal tutor and one external actual expert tutor. By inviting actual instructors and teachers to teach together, the combination of professional courses and actual combat is improved, the teaching content is thematic and project-based, and the cross teaching method of internal teachers and external instructors is adopted to improve students 'practical ability of theoretical practice. Make good use of practice bases, holiday training camps and other practice opportunities, organize and participate in all kinds of network security practice activities, and understand theoretical knowledge more deeply in practice, so as to realize the organic combination of "learning" knowledge and "practicing" skills.

6 Construction of Teaching Quality Monitoring and Continuous Improvement System

The network security talent training program under the OBE concept needs to answer whether students get these learning outcomes. What should students do if they don't get these learning outcomes? Under the background of digital intelligence, the iterative evolution of technology is very rapid. Higher education is faced with the practical problems that the construction of the corresponding talent team and the formation of actual combat capabilities of cyberspace security often lag by 2-3 years, and the adjustment of discipline training programs will lag longer. The development of discipline optimization is a dynamic and long-term process, which needs to build an all-round closed-

loop evaluation system[12]. Therefore, the assessment and evaluation of cyberspace security subject set students 'learning outcomes as the only standard, clarify the expected learning outcomes, design clear and clear evaluation criteria based on the outcomes, and measure students 'learning outcomes from different dimensions such as the attainment of curriculum objectives, the attainment of graduation requirements, and the attainment of training objectives. At the same time, it adopts diversified evaluation methods, combines process evaluation with summative evaluation, focuses on the observation and assessment of students 'learning ability, development thinking and innovation ability, establishes a closed loop system of "evaluation-feedback-improvement", and forms a dynamic adjustment mechanism of continuous improvement.

(1)Evaluation of achievement of course objectives. The assessment and evaluation should fully consider the individual differences of students, and the assessment and evaluation methods should be able to comprehensively measure students 'learning outcomes. Through professional teaching, autonomous learning, experimental practice and other ways, the data of students 'learning outcomes are collected, and different weights are given according to the importance of each evaluation method, and the achievement degree is calculated by the weighted average method. To achieve the purpose of assessing students 'learning outcomes in an all-round way. According to the evaluation and feedback of course goal achievement, it helps teachers to understand the teaching effect, find the problems and shortcomings in the teaching process, so as to improve the teaching content, methods and strategies, and form a closed loop of continuous improvement of course teaching objectives, teaching content and teaching methods.

(2)Evaluation of graduation requirements. The degree of completion of graduation requirements is a comprehensive evaluation of whether students have met the graduation requirements during the entire academic process[13]. Clarify the specific requirements of the knowledge, ability and literacy that graduates should have, and refine the graduation requirements into measurable and observable indicators. According to the graduation requirement index point matrix of curriculum system support, the corresponding weights of different curriculum support are set to observe the completion degree of graduation requirements. Summarize the supporting data of each course on graduation requirements, analyze and calculate according to the calculation method of graduation achievement degree, obtain the overall graduation requirement achievement degree of the major, and compare it with the expected value of the preset professional graduation requirement achievement degree to form the graduation requirement achievement degree evaluation. According to the evaluation situation, form an internal closed loop of continuous improvement of teaching objectives, graduation requirements, curriculum system and curriculum outline[14].

(3)Evaluation of attainment of training objectives. The evaluation of attainment of training objectives is mainly carried out through the survey of professional graduates and social feedback methods[15]. The graduate survey method can use questionnaires, graduate discussion, employment research, students return visit and other ways to track the graduate career development status, post development path, recognition of the professional training objectives, and self-value realization evaluation. Social feedback method can make full use of research, industry-university-research cooperation, internship cooperation, visits and other opportunities to fully understand the degree of fit

between talent needs and training objectives, the degree of fit between graduates 'professional growth and training objectives, and the employer's recognition of training objectives. According to the evaluation and feedback of the achievement degree of various training objectives, a scientific and reasonable index system is constructed, the comprehensive evaluation is carried out regularly, and the sampling evaluation is carried out at different stages, so as to form a closed loop of professional disciplines based on the continuous improvement of political quality, business ability and innovation ability[16].

7   Conclusions

Cultivating high-quality innovative talents in cyberspace security is an important responsibility and goal of colleges and universities across the country, and the cultivation of innovative talents in cyberspace security is a practical need to deal with the new situation of cybersecurity and build a new system of cybersecurity governance. Under the background of digital intelligence, the research on the training of outstanding police talents in network security and law enforcement according to the OBE concept is a process of continuous attempt and exploration.

Acknowledgement

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