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Integration of Science and Education, Innovation and Education-reform and Practice of "ASK" Special Talent Training Model for Cyberspace Security Major

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Abstract: ***In recent years, cyberspace security has become a key issue of national concern. At present, there is a shortage of high-quality professionals in cyberspace security. In view of the current education model, network security talents lack of innovation ability, practical ability is not strong, weak professional knowledge, and does not meet the requirements of safeguarding national network security and building a network power, this paper explores new ideas of network security talent training, and builds a new model of "ASK" characteristic network space security talent training based on the integration of science and education. With the integration of science and education as the main line, three characteristic talent training solutions (namely: Advisor, Speedy, Knowledge-graph) are proposed to ensure the quality of talents in cyberspace security.***

Keywords: Integration of science and education, Cyber space security, Advisor, Speedy, Knowledge-graph**.**

1. Introduction

For the current situation of the development of cyberspace security and the problems faced in the training process of cyberspace security talents, an innovative training mode of "ASK" featured in cyberspace security major is proposed based on the integration of science and education. Taking Qilu University of Technology (Shandong Academy of Sciences) as an example, with the advantage of the integration of science and education, closely centering on the needs of the network space security industry for talent innovation and ability, aiming at the comprehensive quality and personalized development of all students, taking ability training as the key, adhering to the integration of scientific research and teaching, integrating various forms of teaching methods, We will build a high-level cyber security personnel training system based on the background of science and education integration.

2. Situation of Talent Training based on Integration of Science and Education

As early as the 19th century, the University of Berlin proposed the idea of integrating science and education. In Europe, this training method is widely used in various universities. The integration of science and education improves students' practical and innovative ability [1].

In the 18th century, Prussia had twice reformed the quality of higher education, proposed to employ modern philosophy and science to promote universities as sources of creativity. The above changes have provided a solid foundation for the University of Berlin to carry out teaching quality reform. Therefore, it proposed the idea of an ancient academic profession of teachers: the eternal theme of teachers is teaching, and the professional characteristics of university teachers are academic.

Since the 1990s, China has presented education model of integrating science and education, and encouraged universities to apply the model to various teaching fields, and stimulated innovation of students [2]. Although the research of "integration of science and education" started lately in our country, the importance of higher education teaching quality is increasing. In recent years, the country has introduced a series of policies to support the teaching reform, which makes the integration of science and education and the cultivation of talents in colleges and universities become the research hotspot of the teaching reform. The University of Chinese Academy of Sciences, with the foundation of the Chinese Academy of Sciences, has begun to explore the mode of training talents with the integration of science and education in China, promoting the teaching reform with the support of high-level scientific research in colleges and universities, and creating the mode of education with the integration of science and education. This reform has made excellent achievements in personnel training and scientific research, which provides useful reference for universities and research institutes to carry out the integration of science and education.

In May 2017, the new Qilu University of Technology (Shandong Academy of Sciences) was established through integration of the former Qilu University of Technology and Shandong Academy of Sciences. Qilu University of Technology (Shandong Academy of Sciences) gathers the excellent teaching resources in Shandong province, implements the management system integrating the university and the school, and creates the advantages and characteristics of integrated teaching. It is an important force for industrial science and technology innovation and talent training in Shandong Province.

In order to adapt to the rapid development of the cyberspace security situation, practice the spirit of President Xi Jinping

that "make great efforts to cultivate cyberspace talents, pay a lot of money, invite excellent teachers, compile excellent textbooks, recruit excellent students, and build first-class cyberspace security college", give full play to the school's own advantages and strive to form the school's development characteristics. In 2018, Qilu University of Technology (Shandong Academy of Sciences) integrated its College of Information and Shandong Computing Center to build college of cyber space security by utilizing their superior resources. Since establishment, the College has been highly concerned by the leaders of Shandong Province and the university, and its various undertakings have developed rapidly. The development model of the college of Science and education integration based on the integrated management of institutions has taken shape, laying a career foundation and institutional guarantee for the construction of a first-class college of cyberspace security. The idea of science and education integration is applied to the training of talents with security characteristics of cyberspace, makes full use of the engineering practice and scientific research advantages of experts from scientific research institutes to improve the training quality of talents, cultivates talents conforming to the current situation of Chinese cybersecurity, leads the development of innovative talents with science and education integration in cyberspace security, and further improves the training quality of talents.

Qilu University of Technology is the first university approved to build cyberspace security major in Shandong Province, and the college is also the first independently set up cyberspace security college in Shandong Province. Since its establishment, the college has adhered to a high starting point and a high standard to cultivate high-level innovative talents with super security literacy in cyberspace security application, serving the development of Shandong and even the national cybersecurity cause. The enrollment and registration work of the college has been progressing rapidly, and the students admitted to the college have maintained the highest score of the year. Therefore, to carry out the research on the cultivation system and training mode of cyber security talents under the background of the integration of science and education based on agile teaching, make full use of the advantages of college teachers in personnel training and the advantages of experts in scientific research institutes with rich experience in scientific research, so as to organically combine the two and produce chemical reactions, which is conducive to improving the quality of cyber security professional personnel training. To explore the talent training mode and mechanism based on the integration of science and education, cultivate high-quality students into high-quality college graduates, and improve the popularity and reputation of our school.

3. Current Cyber Space Security Personnel Training Model Drawbacks

At present, there are the following drawbacks in the training of cyber security professionals: Network space security personnel innovation ability is insufficient, personnel training is disconnected from the needs of the industry, researchers do not really participate in the training of professional personnel, scientific research resources into teaching resources is not enough, network security new technology does not appear in the teaching content, school teaching and social needs are disconnected, the training of students' innovation ability is insufficient.

Cyber space security personnel are not strong in practical ability. In the process of personnel training, they overemphasize the teaching of theoretical knowledge, "emphasize theory over practice", lack the opportunity and environment to solve practical problems with the knowledge they have learned, and students lack practical ability, systematic thinking ability and practical ability.

The professional knowledge of cyber security talents is weak and the degree of systematic knowledge is not strong. The teaching method based on textbooks leads to the scattered content of professional knowledge points and low correlation degree, which makes it difficult to form a knowledge system with knowledge points as the core. As a result, the knowledge structure of cyber security talents is not systematic and perfect, and it is difficult to meet the needs of students to systematically learn professional knowledge [3].

4. The Reform of Talent Training under Integration of the Science and Education

4.1 New Scheme for Talent Cultivation of Cyber Security based on "Tutor"

To solve the problem of insufficient innovation ability of cyber security personnel, a new scheme of cyber security personnel training based on the "tutorial system" of science and education integration is proposed. Researchers serve as mentors to guide students in their professional and practical courses, transform high-quality scientific research resources into teaching resources, and improve students' innovation ability [4].

The "tutorial system" talent training program is formulated, and academic tutors and scientific research tutors are arranged for undergraduates, simultaneously consolidating students' basic theoretical knowledge and scientific research innovation ability.

The "project-style" professional talent education program is employed, academic and research supervisors are required to select "exploratory" practical topics from research projects and issue guidelines to stimulate students' innovation ability through practical projects.

The scientific research team integrates the latest scientific research and technology development results, prepares training manuals, and links practical application and teaching practice to enhance students' innovation ability.

4.2 New Method for Talent Cultivation of Cyber Security based on "Agile Teaching"

In order to solve the problem of weak practical ability of cyber security talents, a new training method of cyber security talents based on "agile teaching" is designed. Design comprehensive practical training projects for each student to complete in college, stimulate students' potential and enhance their practical ability through practical teaching methods such as iteration, reorganization and feedback.

The teaching method of "small class" for professional courses is carried out. The number of small class is less than 12. Based on actual scientific research and engineering projects, comprehensive practical training topics are formulated for students at the university stage, and students' practical ability is comprehensively evaluated.

It has changed from a rigid curriculum system to a flexible one that can be dynamically adjusted, carried out credit system reform, and incorporated part of national competition results into the credit system management, so as to stimulate students' enthusiasm for active practice and innovation.

Carry out "immersive" practical training teaching, guide students to truly participate in the engineering application projects of scientific research tutors, realize multiple iterations of knowledge learning and practical ability improvement, and calculate practice credits according to performance.

4.3 New Mechanism for Talent Cultivation of Cyber Security based on "Knowledge Graph"

To solve the problem of weak professional knowledge of cyber security talents, a new training mechanism for cyber security talents based on "knowledge graph" is constructed. The visual knowledge map is adopted to sort out the knowledge points of the course content and ensure the systematicness and comprehensiveness of the impartation of knowledge.

Network security "knowledge map" is constructed, knowledge points of cyberspace security subjects are extracted, leading courses and follow-up courses are arranged scientifically with knowledge points as the main line, and a professional knowledge system is constructed.

Based on the "knowledge graph", personalized talent training will be carried out, and outstanding science and education integration scholarships will be set up to honor students with outstanding cyber security abilities, and to cultivate top-notch cyber security talents without any special style [5].

Based on the visualization "knowledge graph", the knowledge structure of the subject is excavated, the extensive teaching mode based on the curriculum is broken, the barriers between courses are broken, and the progressive relationship between knowledge points described by the knowledge graph is used to guide students to carry out systematic learning according to the knowledge modules [6].

5. Effect of Talent Cultivation Reform under the of Integration of Science and Education

Take the School of Cyberspace Security of Qilu University of Technology (Shandong Academy of Sciences) as an example. In the background of the integration of science and education, the school implemented the reform of talent training mode. Within two years, the teaching team of the school has been awarded the "Huangdanian Teaching Team of Shandong Province", the most beautiful teacher of Qilu University of Technology, the Good Teaching Plan of Derong Classroom, the Good Classroom, the good teacher and other teaching honors. The teaching ability and quality of teachers have been greatly improved. At the same time, the faculty of the college has approved 1 major teaching reform project, 2 key reform projects, and more than 10 general teaching reform projects in Shandong Province, published more than 20 teaching reform papers, obtained 1 national first-class undergraduate course and 1 provincial first-class undergraduate course, published 1 Shandong Province planning textbook, and supported the school to be approved as the Shandong Province peak discipline and Shandong Province high-level applied University.

In terms of student training, students have won more than 150 awards for various high-level competitions, including 2 second prizes in national Science and Technology innovation competitions such as "Challenge Cup", 7 first prizes in National College students' information security competition and 5 first prizes in national mathematical modeling competition.

In addition, students of this major have published SCI/EI and other high-level papers and applied for more than 10 patents during the undergraduate period. At the same time, students spontaneously set up a network security association (QLU_SEC) to promote the safety of school cyberspace. Shandong Provincial Department of National Security, Shandong Provincial Bureau of State Secrets Protection and Shandong Provincial Party Committee Network Information Office have all established regular contact with the college. Domestic first-class listed network security enterprises such as Wave Group, Zhongfu Information and Anheng Information have also signed employment agreements with the college.

6. Significance of Talent Cultivation Mode Reform

6.1 Propose New System for Talent Cultivation of Cyber Security based on "Tutor"

To promote the transformation of scientific research achievements into talents training advantages, with the guidance of scientific research projects, carry out the innovation of "tutorial system" talent training mode, adopt the postgraduate management mode for undergraduates majoring in cyberspace security, guide students to carry out exploratory learning and hands-on ability practice as soon as possible, and build a new talent training mode deeply integrating scientific research and teaching; Fully excavate scientific research resources, transform them into the advantages of practical ability training of network security talents, realize the organic integration and innovation of training mode and learning content, and solve the problem of insufficient innovation ability of students.

6.2 Design New Method for Talent Cultivation of Cyber Security based on "Agile Teaching"

The traditional core curriculum should be reconstructed to make it more systematic and flexible, so as to achieve iterative ability training and interdisciplinary and cross-domain knowledge reconstruction. Guided by innovative practical projects, it carries out "immersive" practical training teaching

reform, instructs students to carry out different practical training tasks in different learning stages, and inspires students' potential through practical teaching methods such as iteration, reorganization and feedback. Enable students to truly participate in the development of engineering application projects of scientific research tutors, realize multiple iterations of knowledge learning and practical ability improvement, and record practice credits according to their performance. At the same time, the results of national discipline competitions are included in the credit system management, so as to stimulate students' enthusiasm for active learning and practical innovation.

6.3 Construct New Mechanism for Talent Cultivation of Cyber Security based on "Knowledge Graph"

Design the syllabus and teaching content with knowledge points as the main line, highlight the systematization of professional knowledge, arrange pilot courses and follow-up courses scientifically, break through the barriers between courses, emphasize the flexibility and agility of the teaching process, formulate learning plans according to students' abilities and interests, construct step-by-step learning programs, teach students in accordance with their aptitude, and realize personalized education. The "2+2" talent training program is implemented. In the first two years, students will learn professional basic theoretical knowledge under the guidance of academic mentors, and in the last two years, they will enter the National Supercomputing Center in Jinan to participate in high-level scientific research and engineering projects, which will organically combine curriculum teaching and project practice, break the inherent limitations, and emphasize students' systematic knowledge mastery and profound content understanding. Formation of network security talent discovery, training and evaluation mechanism.

7. Conclusion

At present, by virtue of the advantages of science and education integration, the training quality of cyber space security professionals has been greatly improved. Taking Qilu University of Technology (Shandong Academy of Sciences) as an example, based on the advantages of the integration of science and education in the school, it carries out the new training mode of "ASK" featured cyber space security talents, carries out personalized education for students, and builds a new system of science and education integration. We will give full play to the advantages of integrating science and education to cultivate innovative talents, laying a solid foundation for building a high-level cyber security major and training high-level applied cyber security talents.

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