Research on the Path of Integrating Innovation and Entrepreneurship Education into the Career Development of Computer Network Majors in Colleges and Universities

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Abstract: The development of the digital economy and the advancement of new engineering disciplines have put forward dual demands for computer network professionals to possess both technical capabilities and innovative and entrepreneurial qualities. At present, there are obvious disconnections in the integration of innovation and entrepreneurship education in colleges and universities with the career development of this major. Based on relevant literature research and the professional development characteristics of the computer network major itself, this paper deeply analyzes the integration dilemmas existing in the four aspects of concept, curriculum, practice and faculty. The research focuses on the core positions of the major such as network operation and maintenance, security protection, and scheme design, and then proposes practical integration paths and implementation strategies to provide corresponding reference basis for the reform of talent cultivation in the computer network major in colleges and universities.

Keywords: Education on Innovation and Entrepreneurship; Computer Network major; Career development; Integration paths; Talent development

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Introduction

The rapid iteration and continuous upgrading of the new generation of information technology are driving a significant shift in job demand in the field of computer networks. In the past, industry positions were mostly concentrated in traditional technology operation and maintenance. Now, they are gradually moving towards a composite direction of technological innovation, scenario application, solution design, etc. This has led to stricter standards for the innovative thinking, entrepreneurial awareness and comprehensive vocational ability of practitioners in the industry. According to the Education and Examination Center of the Ministry of Industry and Information Technology and ISC2 (2025) "Cybersecurity Industry Talent Development Report in the AI Era (2025)", the global cybersecurity talent gap rose to 4.8 million in 2025, an increase of 19% year-on-year, and the cybersecurity talent gap in China reached 2 million, an increase of 33% compared with 2023. There are only about 320,000 certified personnel on the job, seriously unbalanced supply and demand [1]. The construction of new engineering disciplines, which is oriented towards industrial demands, emphasizes industry-education integration and practical education, and promotes the deep integration of professional education and innovation and entrepreneurship education, is an inevitable choice for the reform of computer network majors in colleges and universities. At present, there is insufficient connection between the education of this major and career development, and there are obvious shortcomings in the cultivation of students' innovation and entrepreneurship capabilities. It is urgent to explore the integration path of the two. This paper sorts out the intrinsic connection between innovation and entrepreneurship education and professional career development, analyzes the core pain points and proposes feasible strategies to provide theoretical references for similar majors, help optimize talent cultivation programs, enhance students' innovation ability and career fit, and cultivate compound network technology talents.

1.Related Concepts and Theoretical Basis

1.1 Definition of Core concepts

The core objective of innovation and entrepreneurship education is to cultivate students' innovative spirit, entrepreneurial awareness and innovation and entrepreneurship capabilities throughout the entire process of talent

cultivation, with a focus on innovative thinking, problem-solving, teamwork and market insight capabilities, not just to establish enterprises, but to provide support for students' career development throughout the entire cycle.

Computer network professional career development covers students' career positioning, ability enhancement, job fit and career advancement in the network field, with a core focus on key positions such as network design and security, requiring practitioners to have both solid professional foundation and innovative application ability. According to the 2026 National Network Technology Job Demand survey conducted by the Chinese Institute of Electronics in collaboration with Zhaopin.com, network operation and maintenance (74.07%), system operation and maintenance (66.67%), cloud-native development (55.56%), and security integration (40.74%) are the four core positions. 78.6% of the positions explicitly require the ability to apply AI security and design innovative network solutions; Demand for traditional routing and switching positions has declined by 29% in three years, while DevOps and cloud security positions have increased by more than four times in five years. The key to the integration of the two types of education is to embed the concepts, contents and methods of innovation and entrepreneurship into all aspects of professional talent cultivation to achieve the simultaneous cultivation of professional capabilities and innovation and entrepreneurship qualities.

1.2 Theoretical support

The core essence of the industry-education integration theory is to emphasize in-depth cooperation between universities and industry enterprises, and to fully integrate the actual demands of the industry, the latest technical standards, and professional conduct norms into the entire process of talent cultivation. This theory provides important support for the practice-oriented integration path. Specifically, the practical teaching links need to be carried out based on real industry projects to promote the precise matching of talent cultivation and job requirements [2].

Constructivist learning theory advocates a student-centered approach and advocates helping students actively construct knowledge through diverse methods such as practical exploration and project-driven approaches. The theory is of great guiding significance for the reform of practical teaching in schools. It can promote the transformation from traditional verification experiments to project-based learning in real scenarios, thereby stimulating students' desire for active exploration and innovative consciousness.

Career development theory focuses on students' career needs and emphasizes the step-by-step cultivation of students' abilities. This theory provides a basis for the hierarchical design of the integration path, scientifically setting up stepwise innovative practice tasks based on students' growth stages in core positions, and promoting students' abilities to gradually advance from the basic operation level to the program innovation level.

2.Problems in the Integration of innovation and entrepreneurship education in colleges and universities with the professional development of computer networks

2.1 Concepts divorced from job requirements

Some universities have obvious limitations in their understanding of the integration of the two types of education. When promoting the work, they often only do so by offering general entrepreneurship courses, lacking systematic design and not designing the integration content in a targeted manner based on the professional characteristics of the computer network major. Instead, they simply equate innovation and entrepreneurship with guiding students to start Internet companies. This one-sided perception neglects the core innovation demands such as technological innovation, solution optimization, and service upgrading required for network technology positions, and is seriously disconnected from the mainstream career path for students to engage in technical positions and develop steadily after graduation.

According to the China Association of Higher Education (2025), 62.8% of colleges simplify innovation and entrepreneurship education into general education courses, and only 17.6% of network majors design teaching content in line with job innovation demands [3]. At the same time, some professional teachers focus on pure technical

instruction such as routing configuration and protocol principles in teaching, without permeating the concept of innovation and entrepreneurship. When explaining contents such as network topology design, they only demonstrate standard solutions, do not guide students to optimize design and control costs in combination with scenarios, and do not integrate innovative thinking into technical teaching. This also leads to a widespread cognitive bias among students, who believe that innovation and entrepreneurship have nothing to do with professional positions and lack the initiative to explore technical optimization and solve practical problems.

2.2 The curriculum does not align with job requirements

There is a lack of professional specificity in the integration of the curriculum system, and there are problems of excessive generalization and insufficient specialization. Innovation and entrepreneurship general education courses are disconnected from the computer network major. They mostly cover the basic content of general entrepreneurship and do not involve content related to professional career development, which has limited effect on enhancing students' professional innovation ability. Core professional courses do not incorporate innovative elements. For example, the cybersecurity course does not introduce actual job scenarios, and the cloud computing course does not guide the integration of innovative points. In addition, universities do not offer targeted integrated courses, and the curriculum is significantly disconnected from professional career development.

2.3 The practice does not fit the job scenarios

The integration of practical teaching is merely a formality, and targeted content is not designed in accordance with the characteristics of professional practice. The school practice is mostly repetitive verification experiments, focused on the basic operation level, lacking innovative and practical projects that are in line with the actual situation of the profession, making it difficult to cultivate students' innovative ability to solve technical problems. Off-campus practices are mostly visits and observations. Students cannot participate in real work and have no exposure to technological innovation scenarios. At the same time, colleges and universities lack professional innovation and entrepreneurship practice platforms and cannot provide support for technological innovation and entrepreneurship practice, making it difficult to connect with the practical needs of core positions.

2.4 Lack of practical experience in teaching staff

The teaching staff lacks professional fit, making it difficult to support the targeted integration of the two types of education. Although professional teachers have solid theoretical knowledge, they generally lack practical experience on the front line of the industry. Most of them have not participated in actual work such as enterprise network construction and security project optimization. When teaching courses such as network engineering, they are unable to guide students to innovative design in combination with real projects and have insufficient ability to guide students to solve practical technical problems. According to a national survey by the Vocational Education Development Center of the Ministry of Education (2025), 48.4% of computer-related teachers have no work experience in enterprises, and only 13.6% of teachers are proficient in mainstream technologies (such as AI security, cloud-native networks) in enterprises 2024-2025; Only 8.7% of the teachers have participated in real projects such as cyber security attack and defense and enterprise network upgrade [5]. In addition, college part-time teachers lack specificity. 65.2% are general entrepreneurship mentors, and only 18.3% are enterprise experts in cybersecurity and cloud technology.

3.Paths for the Integration of innovation and Entrepreneurship education in Colleges and Universities with the professional Development of computer networks

3.1 Based on the concept of network operation and security position correction

Colleges and universities should, based on the professional characteristics of the computer network major, establish the integrated concept of "technological innovation promoting career and professional entrepreneurship strengthening ability", and abandon the generalization orientation. Carry out specialized training for professional

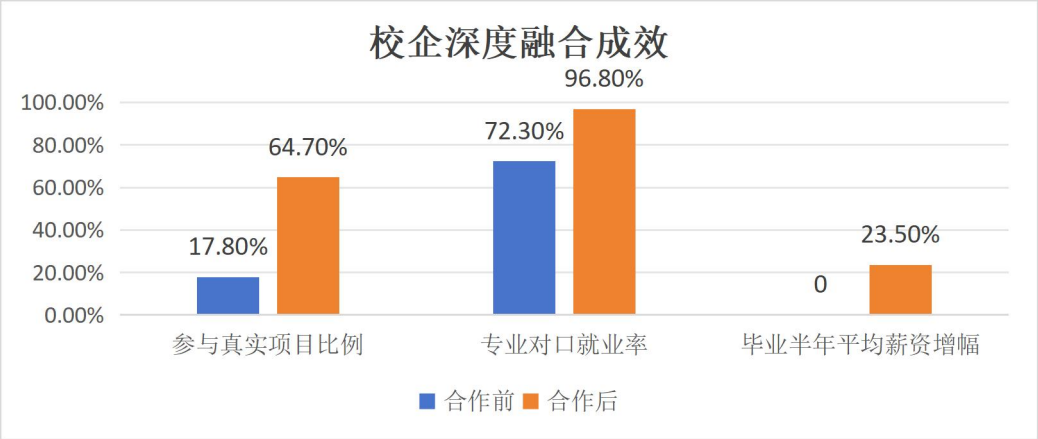
teachers and promote the integration of innovative ideas into technical teaching: When explaining network topology design, guide students to design low-cost and high-stability solutions in combination with campus network and small business network scenarios; When teaching network security content, inspire the exploration of simple and efficient protection innovation methods to make innovative teaching fit technical instruction and job requirements. At the same time, students are presented with core job case studies to correct cognitive biases, clarify that technology optimization, solution innovation, and service upgrade all fall within the scope of innovation and entrepreneurship, emphasize that innovation ability in network operation and maintenance and security protection is a professional core quality, and stimulate students' enthusiasm for participating in professional innovation practice.

3.2 Focus on the integration of network operation and security path optimization courses

Colleges and universities should focus on the three core career paths of network operation and maintenance, security protection, and solution design to optimize the curriculum system and promote the precise integration of innovation and entrepreneurship education with professional education [6]. Optimize innovation and entrepreneurship general education courses, combine general entrepreneurship knowledge with network specialties, guide students to write business plans related to network technical services, campus networks and small business security solutions, and avoid disconnection between general education courses and specialties. Integrate innovation practice into core professional courses: Add topology optimization practice to the Network Principles course, set up vulnerability detection projects in the Network security course, and incorporate cloud desktop solution design in the cloud computing course. At the same time, integrated courses such as Network Technology innovation design and Small Network Service entrepreneurship practice are offered to cultivate students' technical application and problem-solving abilities and achieve a precise match between courses and core job requirements.

3.3 Strengthen the effectiveness of integration in line with the practice of network operation and security

Colleges and universities should focus on the characteristics of computer network professional practice, build dedicated practice platforms, and enhance the effectiveness of integration. Reform on-campus practical teaching, reduce repetitive verification experiments, and add innovative projects such as campus network troubleshooting and optimization, small enterprise network construction, and network security attack and defense simulation to help students enhance their technological innovation capabilities and connect with job requirements. At the same time, colleges and universities should deepen precise cooperation with enterprises, jointly build practice bases with local network service companies, network equipment manufacturers and small and medium-sized enterprises, arrange students to participate in real network operation and maintenance, security hardening, solution optimization and other work of enterprises, let students personally participate in actual projects such as campus network upgrade and security protection of small enterprises, and accumulate industry innovation practical experience. The practical results of the deep integration of schools and enterprises have been verified by many colleges and universities. Take a certain vocational college in Hunan Province as an example. After the establishment of the deep cooperation practice base, the proportion of students participating in real projects can increase from 17.8% to 64.7%, the rate of professional matching employment can increase from 72.3% to 96.8%, and the average salary can increase by 23.5% six months after graduation. In addition, colleges and universities need to build innovation and entrepreneurship practice platforms with professional characteristics, and establish carriers such as cybersecurity innovation studios and small network technology maker Spaces to provide support for students' technological innovation and entrepreneurship practice. At the same time, support students to carry out entrepreneurial attempts such as campus network maintenance services and network technology consultation for small enterprises, and effectively connect with professional career development needs.



3.4 Enhance the integrated teaching ability of network operation and security teachers

Colleges and universities need to build a teaching staff that is suitable for the computer network major and focus on improving the accuracy of integrated teaching by teachers. For professional teachers, universities should develop specialized training programs, strengthen their practical ability cultivation, organize teachers to participate in enterprise network projects, network technology innovation training, arrange teachers to be assigned to network service companies for on-the-job training, let teachers personally participate in actual projects such as campus network upgrade and enterprise security protection, and enhance their ability to carry out innovative teaching in combination with industry reality. In terms of the construction of part-time teaching staff, universities should abandon the generalized recruitment model and focus on hiring technical experts from network equipment manufacturers, successful small network service entrepreneurs, enterprise network operation and maintenance managers and other professional-related talents as part-time teachers. These part-time teachers can combine their own work experience to teach students practical methods of network technology innovation and professional-related entrepreneurship. Share practical content such as the process of starting a small network service business and innovative skills for troubleshooting network faults. At the same time, colleges and universities should establish special incentive mechanisms, incorporate the effectiveness of teachers guiding students to complete network technology innovation projects and participate in professional entrepreneurship practices into the assessment system, fully mobilize the enthusiasm of teachers to carry out professional integration teaching, and improve the quality of integration teaching.

4.Conclusions

It is an inevitable choice for colleges and universities to promote the deep integration of innovation and entrepreneurship education with the professional development of computer networks to meet the demand for compound talents in the industry and improve the quality of training. At present, there are problems in the integration of the two, such as the integration concept being detached from the position, insufficient professionalism of the courses, weak contextualization of practical scenarios, and poor suitability of the teaching staff, which restrict the effectiveness of the integration. To address this, universities can promote the organic connection of the two types of education by correcting the integration concept, optimizing the curriculum, strengthening the integration of practice, and enhancing the capabilities of teachers. This study is based on literature analysis and has limited empirical support. The effectiveness of the approach can be verified through research and case studies in the future. With the development of related network technologies and the update of job competency requirements, the integration content and form need to be optimized simultaneously, which is the focus of future research.

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