

Exploration and Practice of “Four Integration and Four Innovation” Specialized and Creative Integration Talent Cultivation Mode: Taking Chongqing Energy Vocational College as an Example

Liyan Zhang^{1*}, Qingying Zhou², Yueming Zhan¹, Yu Xiao¹, Mingli Chen¹

¹Chongqing Energy College, Chongqing 402260, China

²Chongqing No.94 Junior Middle School, Chongqing 400080, China

*Corresponding author: Liyan Zhang, zhangliyan@cqny.edu.cn

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Abstract: With the release of China Education Modernization 2035, education modernization has become a national strategic goal. In this context, Chongqing Energy Vocational College is actively exploring the “four integration and four innovation” specialized and creative integration talent cultivation mode, aiming at cultivating high-quality talents with innovative spirit and practical skills. This paper analyzes the status quo and challenges of talent cultivation in higher vocational education, puts forward the main practices of innovation-driven, creation and research, cross-border integration, and innovative practice, and has achieved remarkable results. Additionally, it summarizes the experience revelation and provides a reference for other higher vocational colleges and universities.

Keywords: Specialized and creative integration; Talent cultivation; Higher vocational education; Innovation-driven; Cross-border integration

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1. Case background

In February 2019, the Central Committee of the Communist Party of China (CPC) and the State Council issued China Education Modernization 2035 ^[1], which specifies the strategic goal of achieving education modernization in general by 2035, so as to make our country having strong education, learning, human resource, and talent power. In the context of this strategic goal, the innovation-driven development strategy is the core strategy of national development, while the cultivation of innovative and entrepreneurial talents is the most fundamental work for building an innovative country. Through deepening education reform, it is crucial to cultivate talents with innovative spirit and practical skills by closely combining professional knowledge with innovation education and realizing “specialized and creative integration .”

The current status of specialized and creative integration talent cultivation in higher vocational education

shows a positive development trend, but there are still some problems and challenges. First of all, the degree of integration between specialized education and innovation and entrepreneurship education is still not deep enough. The innovation and entrepreneurship courses in some higher vocational colleges and universities are still independent of the professional courses and lack effective connection with professional knowledge. This leads to difficulties for students to transform their professional knowledge into practical applications in innovation and entrepreneurship practice. Secondly, the roles of teachers and students, who are the “double subjects” of innovation education, in the integration of innovation and entrepreneurship education are unclear. In addition, there are some structural problems in the cultivation of talents in higher vocational colleges and universities. For example, the knowledge learned in some majors lags behind the new demands of industrial development, and lacks the consideration of innovation ability, craftsmanship, cross-border integration ability, and other elements. Moreover, innovation and entrepreneurship practice lacks the systematic support of professional courses and practice platforms, which leads to difficulties in carrying out specialized innovation and entrepreneurship teaching.

In view of the above problems in the cultivation of specialized and creative talents in higher vocational education, the Ministry of Industry and Information Technology (MIIT), in conjunction with the “Electronic Information Manufacturing Industry Action Plan for Stabilizing Growth in 2023–2024”^[2], has pointed out that the electronic information manufacturing industry is a strategic, basic, and pioneering industry of the national economy, with a large scale, a long industrial chain, and a wide range of fields. It is an important field for stabilizing industrial growth and maintaining national political and economic security. The electronic information industry has become the core engine of social progress and economic development. As an economic hub in the western region, Chongqing Municipality’s “14th Five-Year Plan” clearly points out that the electronic information industry is the top priority for future development, emphasizing innovation-driven, cluster development, and striving to make breakthroughs in this field. Our school selected electronic information class majors to closely integrate innovation and entrepreneurship education with professional education to explore the practical talent training model, by optimizing the curriculum system, strengthening the practice of teaching, deepening the cooperation between industry, academia, and research, etc., to enhance the students’ innovation and entrepreneurial literacy in all aspects. Through the implementation of the above initiatives, our university has achieved remarkable results in the cultivation of talents with the integration of specialization and entrepreneurship. Students’ innovation ability and entrepreneurial literacy have been comprehensively improved, and they have achieved excellent results in various competitions and practices, while a number of outstanding graduates with innovation spirit and entrepreneurial ability have emerged.

2. Key practices

2.1. Innovation-driven and specialty-based: A new structure for a talent training system that integrates innovation and specialization in depth

- (1) Constructing innovative professional curriculum system^[3]: In order to realize the organic integration of specialized education and innovation and entrepreneurship education, we revise the talent cultivation program and take “Innovation and Entrepreneurship Education” as the public general knowledge core course to ensure that every student receives systematic innovation and entrepreneurship theory education. In the first and second semesters, special innovation general knowledge courses and primary training are offered to improve special innovation cognition, entrepreneurship cognition, and self-knowledge. In the third semester, advanced training, special lectures, and simulation exercises are provided to learn business opportunity identification. Fourth semester offers professional training

and entrepreneurship training, organizes preparation for competitions, and explores high-quality entrepreneurial projects. In the fifth and sixth semesters, students' entrepreneurial landing projects can be admitted to the incubator, providing one-stop services.

- (2) Implementing the practical teaching mode of “integrating classroom and competition and competition and teaching”^[4]: We incorporate practical teaching activities such as dual-creation contests and skills competitions into the curriculum system, and closely connect them with the design of professional courses, top internships and graduation design, and other teaching links. The core concept of this teaching mode is “promoting learning by competition” and “promoting teaching by competition.” Through the competitions, students can exercise their practical skills, and improve their hands-on ability and thinking skills. Teachers can continuously enhance their teaching level through interaction and cooperation with students, realizing the mutual benefit of teaching and learning.
- (3) Introducing new initiatives to train talents with the latest technology and industry dynamics in the electronic information industry: We introduce cutting-edge technology and the latest developments in the industry into the curriculum system. By offering cutting-edge technology courses such as Introduction to Electronic Information and Comprehensive Practice of Electronic Information, and by organizing industry lectures and enterprise practice, we enable students to adapt to the development of society, and their professional ability to keep up with the industrial demand.

2.2. Creating and researching: A new mechanism for talent cultivation that integrates teachers' and students' professionalism and in-depth innovative thinking

- (1) Promoting the new form of the construction of the system of specialization and innovation integration^[5]: The school encourages teachers to actively participate in the work of post-creation integration and to play a leading role in innovation and entrepreneurship education through policy measures such as making qualifications for promotion in the evaluation of job titles and prioritizing the promotion of salary and treatment. At the same time, the school implements the policy of mutual recognition of credits for students who have made achievements in innovation and entrepreneurship education, recognizes their excellence in their disciplines, and gives policy preference to them in the evaluation of merits and priorities. The school establishes a sound monitoring and evaluation mechanism for the work of specialization and innovation integration to ensure that all policies and measures are implemented and effective.
- (2) Improving the new model of educating people with the dual roles of professional teachers and entrepreneurship mentors: We have set up a “professional + entrepreneurship” integrated team of teachers, combining professional technological innovation, vocational skills upgrading, craftsmanship updating and entrepreneurship, specializing in the integration of creativity, and promoting the implementation of innovative scientific and technological projects.
- (3) Exploring the new path of professional skills learning and innovative and entrepreneurial thinking training led by associations and societies^[6]: Specialized and creative integration associations are established on the basis of specialization, which is an extension of specialized and creative education in the classroom and an important carrier of innovative practice. The associations and societies stimulate students' innovative thinking and entrepreneurial enthusiasm by organizing lectures and professional seminars, and sharing excellent cases of entrepreneurship. They also cooperate with enterprises, universities, and research institutions to provide students with more practice opportunities and employment resources. Students understand the needs and trends of the industry and accumulate entrepreneurial experience through exposure to real project cases.

2.3. Cross-border integration for innovation and empowerment: A new alliance for school-enterprise integration and specialized talent cultivation

Through the establishment of in-depth cooperation with Huawei, Sinosoft International, and other leading enterprises in the industry, we have opened up the six-dimensional support of “experience, training, practice, transformation, incubation, and service.” It realizes the effective docking between educational resources and industrial resources and provides strong support for the cultivation of high-quality and innovative electronic information professionals ^[7].

- (1) Deepening school-enterprise cooperation and building practice teaching bases together: We have established close cooperation with Huawei, Sinosoft International, and other enterprises to build industrial practice teaching bases. The industrial base not only provides students with advanced experimental equipment and high-quality industrial teaching resources but also introduces the actual projects and technical needs of enterprises. We integrate the advantageous resources of schools and enterprises, incorporate new technologies, processes, and specifications into the teaching content, and achieve the combination of work and study, and knowledge and practice, so that the students’ professional learning and skills enhancement meet the talent standards of the Ministry of Education’s new era electronic information and needs of the enterprises.
- (2) Carrying out joint training to realize the co-cultivation of talents: We cooperate with enterprises to carry out joint cultivation projects, formulate cultivation plans together, and realize talent co-cultivation. By introducing the talent cultivation system and resources of enterprises, students can familiarize themselves with the work-learning ecological mode of enterprises in advance and understand the latest technology and industrial dynamics of the industry. At the same time, the enterprise mentors will also participate in the students’ internship training and graduation design to provide practical opportunities and guidance for the students.
- (3) Establishing faculty sharing to improve teachers’ practical skills: We cooperate with enterprises to establish a faculty sharing mechanism, inviting enterprise experts to serve as part-time teachers or offer lectures to teach students practical experience and industry knowledge. At the same time, we also encourage teachers to participate in the research and development projects and technical services of enterprises, so that teachers’ knowledge and ability can be aligned with the industry, and teachers’ practical skills and industry knowledge can be improved.
- (4) Improving the cooperation mechanism to ensure the smooth progress of industry-university-research cooperation ^[8]: We have established a perfect cooperation mechanism with enterprises, and jointly built “dual-creation experience area, dual-creation training area, dual-creation practice area, project incubation area, and entrepreneurship service area,” so as to build a dual-creation education eco-space based on market-oriented operation. The university and enterprises jointly build a training and experience center to carry out dual-creation experience and training. School-enterprise co-establishment of incubation bases to carry out project incubation. The university and enterprises jointly build a mass innovation space to provide specialized and creative integration practical training; and co-establish a science and innovation industrial park to build a platform for the transformation of achievements.

2.4. Innovation and practice for craftsmanship and talent casting: A new platform for the deep integration of specialized and creative integration talent cultivation and practice by government, enterprise, and schools

We constructed an ICT (information and communications technology) industry talent training platform

supported and guided by the policies of the Jiangjin District Government, and integrated by Huawei ICT Industry Academy and Chongqing Energy Science and Technology Park, jointly promoting the innovation and development of the talent training model ^[9].

- (1) Establishing a diversified ICT practice platform: Through Huawei ICT ecosystem enterprise resources, the support of the Jiangjin District Government, and the educational resources of Chongqing Energy Science and Technology Park, we have completed the post-course-competition-certificate integration system for the ICT industry, based on which students can participate in Huawei eco-chain enterprise projects, professional skills training, competition resource docking, Huawei ICT certificate recognition, and Huawei eco-chain enterprise employment resources. This system provides students with a full chain of services, including professional learning, skill improvement, employment practice, and employment resources.
- (2) Strengthening the combination of practical teaching and theoretical teaching: We emphasize the organic combination of practical and theoretical teaching on the platform of government-enterprise-school integration, and carry out practical teaching throughout the whole ICT training process. In theoretical teaching, we focus on guiding students to master the cutting-edge technology and development trends of modern enterprises; in practical teaching, we focus on cultivating students' ability to solve practical problems for enterprises and governments. Through the mutual corroboration of theory and practice, students are able to better master the professional knowledge and skills of electronic information and realize the transformation of knowledge to skills.
- (3) Carrying out project-based practical teaching: In order to improve students' practical skills and teamwork, we adopt Huawei ecosystem enterprise industry projects, and guide students to exercise their professional skills and innovation ability in the process of project development through real front-line enterprise projects. At the same time, we allow students to better understand the industrial employment ecology and demand, and meet the ICT talent needs of enterprises and the government.

3. Results

3.1. Implementation results

Through the implementation of the specialized and creative integration education model, our school has achieved remarkable results in the education of electronic information majors:

- (1) The good results of the competitions show the light of cultivating creative talents: In 2023, students participated in the China International University Student Innovation Competition, "Challenge Cup" National University Students' Extracurricular Academic and Technological Works Competition, "Challenge Cup" China University Students' Entrepreneurship Plan Competition, and China Vocational Education Innovation and Entrepreneurship Competition. The students won two silver awards at the national level, two gold awards at the municipal level, one special award at the municipal level, one first award at the municipal level, six silver awards, and four bronze awards. Students participated in the "Belt and Road" and BRICS Skills Development and Technology Innovation Competition, National College Students Electronic Design Competition, "Hetai" Cup Chongqing College Students Microcontroller Application Design Competition, Chongqing Higher Vocational Institutions Students Vocational Skills Competition "Internet Application Technology" competition. In the "Internet Application Technology" and "Embedded Application Technology Development" competitions, we won one national first prize, one second prize, one national third prize, and one first prize in Chongqing Municipality. Students participated in the "Sinosoft Excellence Cup Technology Competition Season 2"

in 2023 and won the first prize.

- (2) Honors help students sublimate their self-knowledge: Three students won the National Inspiration Scholarship in 2023, 15 students were exempted from the examination for the China International Student Innovation Competition and successfully promoted to bachelor's degree. One student won the Star of Self-Improvement of Chinese University Students, and one student was awarded the honorary title of the Three Good Students of Chongqing Municipality.
- (3) Teachers' reputation reflects the glory of teachers' specialization: We have set up 50 innovative teacher teams, approved two municipal professional teaching resource libraries, published seven textbooks and monographs, successfully selected the textbook *Foundation of Innovation and Entrepreneurship for College Students (2nd Edition)* as the national teaching material of the "14th Five-Year Plan," developed five three-dimensional teaching materials and high-quality courses at the university level. We have also successfully recognized one municipal-level quality online course "Innovation and Entrepreneurship Education," implemented 28 items of mutual recognition of credits, and won the second prize in the BRICS Vocational Skills Competition of Manufacturing Robotics International Competition. One person was invited to be a judge of the BRICS Internet of Things Competition, and five people were honored as excellent entrepreneurship mentors at the municipal level.
- (4) Specialized and creative integration talent cultivation promotes students' employment: 2023 graduates of Electronic Information Technology major have a high employment rate of 99.33%, and the positive evaluation and high recognition from enterprises fully proved the success of the specialized and creative integration talent cultivation mode of Electronic Information Technology major. Taking Song Liu, an outstanding graduate of the 2023 Internet of Things Application Technology Program, as an example, in January 2023, he joined Hikvision as a performance test technician and quickly became prominent with his profound technical skills. In April of the same year, due to his outstanding performance, he was recruited to a higher-level position and was given a one-month study opportunity at headquarters. In May, he was successfully promoted to process engineer trainee.
- (5) The honor of association innovation highlights the far-reaching influence of specialized and creative integration talent cultivation: The Internet of Things Association of our university was honored as the excellent association of innovation and entrepreneurship in Chongqing. The "Five Degrees of Youth Creation+" Innovation and Entrepreneurship Ecosystem Cultivation Project of the Electronic Information Class of our university was awarded as the excellent student association project brand in the cultivation and construction of excellent student associations and project brands of "one school, one association, and one product" of Chongqing universities in 2023. These honors are not only the affirmation of the Association and the excellent student association project brand cultivation and construction work but also the recognition of the whole model of integrated education.

3.2. Results summary

In the process of exploring and practicing the "four integration and four innovation" specialized and creative integration talent cultivation mode, we have achieved remarkable results and summarized the following experiences:

- (1) Innovation-driven, professional foundation-building establishes a new structure of talent cultivation system: By building an innovative professional curriculum system, we have realized the organic integration of professional education and innovation and entrepreneurship education and ensured that students receive systematic innovation theory education. The implementation of the teaching mode

of “one course, one competition, one teaching” has effectively improved students’ practical skills and teachers’ teaching levels. At the same time, the introduction of the latest technology and dynamics of the electronic information industry allows the students’ professional ability to keep up with the needs of the industry. Together, these initiatives have promoted a significant improvement in the quality of talent training and laid a solid foundation for cultivating high-quality and high-skilled talents.

- (2) We have created a new mechanism for talent cultivation through the parallel progress of creation and research, and the peer-to-peer cooperation between teachers and students. We have successfully promoted the construction of the system of integration of specialization and entrepreneurship and ensured the active participation of teachers and students through policy incentives and evaluation and supervision, as well as the achievement of practical results; improved the dual education model of professional teachers and entrepreneurship mentors; and explored the new path of association societies to lead the education of professional-venture integration. These initiatives have effectively integrated professionalism and innovative thinking, and cultivated high-quality talents with innovation and entrepreneurship.
- (3) Cross-border integration, innovation, and empowerment build a new alliance for talent cultivation: Through in-depth cooperation with Huawei, Sinosoft International, and other leading enterprises in the industry, we have successfully constructed a new alliance for school-enterprise integration and specialized talent cultivation. We have jointly built practice teaching bases, integrated school, and enterprise resources, and realized the effective docking between educational resources and industrial resources; establishing the mechanism of sharing teachers and strengthening the cooperation between industry, academia, and research. By improving the cooperation mechanism, guaranteeing the smooth progress of industry-university-research cooperation, and building a dual-creation education ecological space based on market-oriented operation, these initiatives have injected new momentum into the cultivation of high-quality and innovative electronic information professionals for the industry.
- (4) Innovative practice and craftsmanship build a new platform for cultivating specialized and creative talents: Relying on the policy support of Jiangjin District Government and the resource integration of Huawei ICT Industry College and Chongqing Energy Science and Technology Park, we have established a diversified ICT practice platform and carried out project-based practice teaching, which comprehensively improves students’ practical skills and innovation ability. These initiatives effectively promote the docking between talent training and industrial demand and provide strong support for the cultivation of high-quality and innovative electronic information professionals.

4. Conclusion

The article summarized the practical experience of Chongqing Energy Vocational College’s “four integration and four innovation” specialized and creative integration talent training mode, emphasized the importance of the deep integration of innovation education and professional education, and provided new ideas and methods for the reform of talent training mode in higher vocational colleges and universities.

Disclosure statement

The authors declare no conflict of interest.

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