https://doi.org/10.62836/jissh.v3i2.0009

Global Science Publishing

JISSH

Journal of Integrated Social Sciences and Humanities

https://ojs.sgsci.org/journals/jissh

Article

Reform and Practice of the "C+X" Cultivation Model for Regional Application-Oriented Innovative Talents Amid Industry-Education Integration and AI Empowerment

Fenghua Huang *, Ling You and Guihong Sun

College of artificial Intelligence, Yango University, Fuzhou 350015, China

Abstract: The development of regional application-oriented innovative talents that are consistent with local economic and social development is one of the main missions of most regional application-oriented universities in China. Over the last few years, a new generation of information technologies, such as artificial intelligence, big data, and digital twins, has radically changed the structure of industries and talent demand trends in the country. Nevertheless, the conventional talent development model of computer science and technology majors is usually characterized by the lack of interdisciplinary integration in the curriculum design, instructional practices, and practical training, and the lack of relationship with industry demands. Consequently, there has been a growing challenge in nurturing the interdisciplinary, application-based and innovative skills needed to achieve high-quality regional economic growth. In the eyes of regional application-oriented undergraduate universities, this paper suggests and logically develops the C+X talent development model of regional application-oriented innovative talents in the framework of industry-education integration and AI-empowered education. Through an analysis of reforms and practices in training objectives, curriculum systems, teaching models, practical frameworks, and support mechanisms, this study explores a pathway toward deep industry-education integration supported by AI technologies. The current practical results indicate that the C+X model of cultivating engineering practice is effective in improving the engineering practice ability, industry flexibility, and innovative competence of students, and thus offer useful information to the redesign of talent development in computer-related majors in local application-oriented universities.

Keywords: industry-education integration; AI-empowered education; C+X model; application-oriented universities; cultivation of innovative talents

1. Research Background and Significance

As the new-generation information technologies, including artificial intelligence, the Internet of Things, and big data, are rapidly developing, the digital and intelligent transformation of industries in different regions of China is gaining momentum. Consequently, the demand for information technology talents in regional economic development has shown a pronounced trend toward greater specialization and stronger practical competence. In recent years, the Chinese government has issued a series of national policy documents, including the Opinions of the General Office of the State Council on Deepening the Integration of Industry and Education [1] and the Pilot Implementation Plan for the Construction of National Industry-Education Integration [2]. These documents

Received: 5 April 2026; Accepted: 20 April 2026.

* Corresponding: Fenghua Huang (fhhuang@ygu.edu.cn)

explicitly call on colleges and universities to proactively respond to industrial needs, deepen industry-education integration, and enhance the alignment between talent cultivation and economic and social development. In doing so, they provide clear guidance for reforming talent cultivation models at regional application-oriented undergraduate universities in the context of industry-education integration [3]. Regional application-oriented universities undertake the important mission of serving local industrial development and cultivating high-level technical and skilled professionals. Computer Science and Technology is one of the traditional majors widely offered at these institutions.

Nevertheless, the Computer Science and Technology program in certain regional application-oriented universities continues to encounter a number of typical issues in talent development, such as overemphasis on theory, limited knowledge base, a lack of connection between practical instruction and real-world engineering situations, and technologically skilled students with little understanding of the industry. These problems tend to cause a long period of adaptation post-graduation and lack of innovative ability. The “C+X” model refers to the interdisciplinary integration of Computer Science and Technology (C) with other disciplines (X), such as transportation, finance, surveying and mapping, and aerospace. In the context of industry-education integration, this talent cultivation model not only develops students’ interdisciplinary thinking skills but also stimulates their innovative potential, thereby providing strong talent support for regional economic and social development. Furthermore, the growing application of artificial intelligence in education and teaching in recent years has created new tools and approaches for restructuring “C+X” teaching content, innovating instructional models, and reforming learning assessment methods [4].

This paper proposes a “C+X” cultivation model for regional application-oriented innovative talents in the context of industry-education integration and AI empowerment. It aims to promote the transformation of talent cultivation in computer-related majors from a “general” model to a “composite, application-oriented, and innovative” approach through deep industry-education integration and AI-enabled education. In addition, the paper takes the construction of the national first-class undergraduate program in Computer Science and Technology at Yango University, a representative regional application-oriented undergraduate institution, as a case study for empirical analysis.

2. Connotation of the “C+X” Cultivation Model for Regional Application-Oriented Innovative Talents

2.1. Adhere to the CDIO + OBE Engineering Education Concept

CDIO is the entire process of Conceive, Design, Implement, and Operate and is an educational model that aims at developing engineering practice skills in students [5]. Its main idea is to lead students through the whole process of product research and development, thus enhancing their engineering theoretical base, professional skills, teamwork competence, and systems engineering skills. The model has been extensively used in new engineering education practices in universities [6]. Outcome-Based Education (OBE) is a teaching philosophy that is outcome-oriented, student-centered and continuously improving. It underlines the explicit specification of learning outcomes and the successful execution of target requirements [7]. The extensive combination of CDIO and OBE ideas (CDIO + OBE) not only allows defining the learning goals accurately and making the training process effective, but also facilitates the development of innovative teaching strategies and practical training. It assists students to learn and practice skills by engaging in practical activities, thus holistically developing their overall competencies. Computer Science and Technology, as one of the main fields of the new engineering education system, is the main platform on which the application of the model of cultivating regional application-oriented innovative talents of C+X can be carried out. Its main philosophy and theoretical basis of reform is the CDIO + OBE concept [8]. Moreover, it is necessary to actively align with the requirements of accreditation of engineering education, optimize and redesign talent training programs and curriculum systems according to the accreditation requirements, and create a closed-loop quality assurance system of evaluation-feedback-optimization [9,10].

2.2. Adhere to the Industry-Education Integration and Prioritize Serving Regional Industries

Industry-education integration is a key approach to linking the education chain, talent chain, industrial chain, and innovation chain. The corresponding research has proved that the joint work of universities and businesses in the development of training plans and the creation of curriculum systems and practical platforms can contribute greatly to the quality of talent development and the employment flexibility of graduates. Local colleges and universities should firmly uphold their core mission of serving regional industries, align with local industrial development needs, work closely with enterprises to optimize talent training programs, establish industrial colleges and internship training platforms, and cultivate high-level, application-oriented professionals who meet enterprise demands [11,12].

2.3. AI-Empowered Education and Teaching

With the rapid advancement of artificial intelligence technology, its value in the education sector has become increasingly prominent. Its applications mainly include intelligent teaching assistance, analysis of teaching behavior data, personalized learning plan recommendations, and intelligent evaluation of teaching effectiveness, among other functions [13]. Within the context of industry-education integration, AI technology can further promote learner-centered precision teaching, enrich industry-oriented teaching scenarios and practical cases within the "C+X" framework, improve teaching efficiency and training quality, and provide strong technical support for innovation in talent cultivation models [14].

3. Reform Path of the "C+X" Cultivation Model for Industry-Education Integration Talents

3.1. Establish an Interdisciplinary Applied Talent Training System

Application-oriented universities should vigorously promote the development of interdisciplinary specialty clusters, break down barriers between disciplines and majors, and establish an interdisciplinary talent cultivation framework characterized by deep collaboration between universities and enterprises, guided by the needs of regional industries. By integrating with the application scenarios of local industries, they should optimize talent training programs through industry-education integration, explore core "C+X" application scenarios, and offer cross-disciplinary courses to broaden students' knowledge base and enhance their employability.

3.2. Reconstruct a Characteristic Applied Curriculum System

In alignment with the needs of regional industrial development, the original training program for computer-related majors should be systematically optimized, and a curriculum structure consisting of "professional foundations + industry applications + typical cases" should be established. In particular, professional foundation courses are to be oriented towards enhancing core computer literacy; industry application courses are to be oriented towards cross-integration of computer technologies with particular industries; and typical case courses are to present representative C+X project cases. By utilizing a smart teaching cloud platform, students' autonomous learning, course progress, experimental practice, and assessment performance can be tracked throughout the entire process, enabling the dynamic optimization of the curriculum system and teaching content accordingly.

3.3. Foster Innovation in Education and Teaching Methods through AI Technology

In teaching practice, project-driven and problem-oriented instructional approaches should be integrated, with authentic enterprise projects incorporated into classroom teaching. Through an AI-assisted teaching platform, students' learning status can be analyzed in real time, enabling personalized guidance and dynamic, process-oriented evaluation throughout the learning process. A dual-mentor system should be implemented, involving both university faculty and frontline industry engineers, to jointly guide and mentor students.

3.4. Reconstruct the Practical Teaching System Integrating "Industry, Education, Research and Competition"

Taking the deep integration of industry, education, research, and competition as the focal point, students can cultivate innovative thinking, practical abilities, and an entrepreneurial spirit through real-world project practice.

It should be a hierarchical and comprehensive application-based practical teaching system, which includes the main elements of course-based experiments, academic competitions, cognitive internships, enterprise-based internships, and graduation projects. By leveraging an intelligent experimental teaching cloud platform and a laboratory open-access mechanism, the scenarios and scope of practical teaching can be further expanded.

3.5. Strengthen the Construction of "Dual-Qualified and Dual-Capable" Faculty and Support System

A faculty development strategy that combines recruitment and training should be adopted, with a focus on introducing engineers with frontline R&D experience from enterprises to undertake practical teaching responsibilities. At the same time, existing academic staff should be encouraged to transition into "dual-qualified and dual-competence" teachers by actively participating in enterprise projects and technological R&D, thereby enhancing their engineering practice capabilities. A three-level teaching quality supervision mechanism should be established at the university, college, and department levels, along with a teaching quality evaluation and continuous improvement system guided by the OBE philosophy. These measures provide institutional support for the efficient operation of the "C+X" talent cultivation model [15].

3.6. Co-Construct High-Quality Internship Bases through School-Enterprise Collaboration

Based on the diverse application domains of computer technology, several industry-leading enterprises should be selected to co-establish high-quality internship and training bases, following the principle of mutual benefit among universities, enterprises, and students. Priority should be given to enterprises and institutions within the region that demonstrate strong disciplinary alignment, standardized management, advanced technologies, and high demand for skilled talent. The operation of these internship bases should adhere to principles such as meeting instructional needs, mutual benefit, continuous optimization, and regional accessibility [16].

4. Analysis of Reform Practice Cases and Achievements

Taking Yango University, a typical regional application-oriented undergraduate institution, as an example, this article presents the reform measures and outcomes of its Computer Science and Technology program in advancing the "C+X" cultivation model for regional application-oriented innovative talents. Established in 2001, the program was designated as a demonstration application-oriented undergraduate major in Fujian Province in 2016, selected as a pilot program for comprehensive "holistic education" reform in Fujian universities in 2019, and approved as a national first-class undergraduate program construction site in 2022. The program has followed the educational philosophy of focusing on moral integrity and technical competence, focusing on application, and reinforcing practice, over the last 20 years, with the goal of producing high-quality applied technical talents who not only understand technology, but can develop and are good at application. Its basic curriculum covers Advanced Programming Languages, Data Structures, Principles of Computer Organization, Operating Systems, Computer Networks, and application courses based on industry. The program has recorded great results in the past few years in terms of encouraging the reform of the C+X model of cultivating regional application-oriented innovative talents, the rate of graduate employment is over 95%, the rate of professional-job matching is almost 80% and the rate of students going on to postgraduate studies is steadily increasing. The main reforms of the program are as follows:

(1) Establishing a "C+X" education model with regional characteristics: It is against this background that the Fujian Province is still pursuing the Digital Fujian strategy and actively developing its digital economy that a disciplinary cluster based on data intelligence is being established by incorporating majors like Data Science and Technology, Artificial Intelligence, Network Engineering, and Software Engineering. Meanwhile, customized talent training programs are being designed, common application scenarios are being investigated, and cross-disciplinary courses are being provided to expand the knowledge base of students and increase their chances of employment in five major local industrial sectors, such as education, agriculture, community services, environmental protection, and surveying and mapping.

(2) Fostering a robust industry-education integration ecosystem with local enterprises: Leveraging provincial- and ministerial-level research platforms, as well as the strong industry background and resource advantages of the university's founding organization, a robust industry–education integration ecosystem has been developed in collaboration with local enterprises. For example, the university has co-founded the first batch of "Intelligent Information Technology" modern industry colleges in Fujian Province with Fujian Electronics and Information Group; established the "Fuzhou ICT Application-Oriented Talent Training Alliance" with 30 enterprises, including Newland and the Huawei (Fuzhou) Cloud Computing Innovation Center; jointly built the "Internet of Things Public Service Platform" with FIoT-LAB and established an IoT rapid prototyping and manufacturing platform; and collaborated with Star-net to establish the "National and Local Joint Engineering Laboratory for Next-Generation Networks, Yango University Branch Laboratory." A multi-level, application-oriented practical teaching system integrating production, teaching, research, and competition has been developed, emphasizing scenario-based learning and practice-oriented instruction. The number of students participating in enterprise-based internships through school – enterprise joint training programs has continued to increase year by year.

(3) Vigorously advancing the development of "Dual-Qualified and Dual-Capable" faculty: In recent years, the program has recruited more than 30 technical experts and senior engineers from relevant enterprises through a combination of talent introduction and targeted training initiatives. In addition, some faculty members have been sent to enterprises for industry-based training and professional skills development. As a result, the proportion of "dual-qualified and dual-capable" teachers has increased to over 50%, significantly strengthening their abilities in teaching practice-oriented courses, engaging in applied project research and development, and supervising academic competitions.

(4) Enhancing AI and real project-driven teaching approaches: Authentic enterprise projects from Fujian Province are integrated into classroom instruction, while project-driven and problem-oriented teaching methodologies are further strengthened. By leveraging AI technologies to empower classroom teaching, analyze student learning behaviors, and provide personalized learning recommendations, the program aims to improve students' learning efficiency and enhance their problem-solving and analytical abilities.

5. Existing Problems and Countermeasures

Currently, against the backdrop of industry–education integration and AI empowerment, local application-oriented universities still face several challenges in the reform and implementation of the "C+X" cultivation model for regional application-oriented innovative talents. These challenges include difficulties in achieving a balanced "triple-win" outcome among universities, enterprises, and students in the process of industry – education integration, limited interdisciplinary research capacity among faculty members, and an imperfect evaluation system for both teachers and students. It is therefore recommended that regional application-oriented universities further refine mutually beneficial mechanisms for industry–education integration, establish a sound evaluation, incentive, and accountability system for faculty and student participation, and consistently adhere to the core principles of OBE. Emphasis should be placed on strengthening application-oriented characteristics aligned with regional economic and industrial development, encouraging faculty to engage in interdisciplinary research, enhancing industry-oriented skill development for teachers, and promoting the continuous optimization and broader implementation of the "C+X" talent cultivation model. In addition, guided by the Engineering Education Accreditation Standards and regional industrial demands, continuous efforts should be made to advance the accreditation of Computer Science and Technology programs, establishing a closed-loop "evaluation – feedback – improvement" mechanism to drive the ongoing refinement of the "C+X" talent cultivation model.

6. Conclusions

Against the backdrop of industry–education integration and AI empowerment, the establishment of a "C+X" cultivation model for regional application-oriented innovative talents represents an effective approach to reforming computer science programs in application-oriented universities. Key strategies for advancing the reform of the "C+X" industry – education integration talent cultivation model include developing a multidisciplinary, application-oriented talent training framework, reconstructing a distinctive applied curriculum system, implementing AI-driven reforms in educational methods and teaching practices, strengthening the development of "dual-qualified" faculty teams and supporting mechanisms, and establishing high-quality internship and training bases. Practical experience demonstrates that this model significantly enhances students' engineering practice skills, industry adaptability, and innovative capabilities, thereby improving the quality of talent cultivation for regional application-oriented universities and strengthening their capacity to serve regional economic development. It also shows strong potential for wider promotion and application.

Funding

This work was funded by the projects: Fujian Provincial 2024 Undergraduate University Education and Teaching Research Project (FBJY20240269): Reform and Practice of a Cultivation Model for Regional Application-oriented Innovative Talents Targeting "C+X" Multi-disciplinary Integration in the Context of Industry-education Integration; Fuzhou Private Higher Education Development Special Project for 2025-2026 ("AI+N" Industry-Education Integration Training Center).

Author Contributions

Writing—original draft, F.H., L.Y. and G.S.; writing—review and editing, F.H., L.Y. and G.S. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

References

1 General Office of the State Council. Several Opinions on Deepening the Industry-Education Integration. *Bulletin of the Ministry of Education, the People's Republic of China* 2017; (**12**): 2–9.

2 National Development and Reform Commission, Ministry of Education, Ministry of Industry and Information Technology, *et al*. The Notice of Issuing the Implementation Plan for the National Pilot Program of Industry-Education Integration. *Bulletin of the Ministry of Education, the People's Republic of China* 2019; (**10**): 1–9+15.

3 Wang F. Optimization of Talent Cultivation System in Applied Undergraduate Colleges under the Background of Industry-Education Integration. *Industrial Innovation* 2025; (**10**): 174–176.

4 Li M, Xu Z, Ge LM, *et al*. "Artificial Intelligence+" Empowering Higher Education: Theoretical Logic, Practical Predicament and Practical Path. *Scientific Management Research* 2024; **42**(**05**): 57–65.

5 Dai F. Analysis of Teaching Reform Strategies for Computer Science under the CDIO Concept. *Journal of Harbin Vocational & Technical College* 2026; (**01**): 34–36.

6 Wang WW. Research on the Teaching Mode of Computer Professional Courses Based on the CDIO Concept. *Education and Teaching Forum* 2025; (**33**): 157–160.

7 Yang L, Duan HL. Exploration on the Cultivation of New Engineering Artificial Intelligence Professionals

Based on OBE Concept. *Heilongjiang Education (Theory & Practice)* 2026; (**03**): 9–12.

8 Zhu GL, Yuan CX, Pan ZG, *et al*. Construction of Computer Science Talent Cultivation Model Driven by Digital Intelligence Empowerment and Engineering Education Accreditation. *Software Guide* 2026; 1 – 8. Available online: https://link.cnki.net/urlid/42.1671.TP.20260211.1124.002 (accessed on 1 April 2026).

9 Zhao J, Zhang LY, Ding Y. Research on the Cultivation of Innovative Talents in Computer Science under the Background of Professional Accreditation of "New Engineering" Engineering Education. *Journal of Changchun Institute of Technology (Social Sciences Edition)* 2023; **24**(**02**): 89–93.

10 Wang CY, Zhang Y, Ren CH. Exploration of the Curriculum Reform Path of Computer Major in Applied Undergraduate Education under the Background of Engineering Education. *Computer Knowledge and Technology* 2025; **21**(**24**): 156–159.

11 Huang JJ, Huang JH, Lu L. Exploration and Practice on the Cultivation of Computer-Related Professional Talents under the Background of New Engineering. *Computer Knowledge and Technology* 2024; **20**(**06**): 159–161.

12 Wei L, Li M, Lu GY. Construction and Practice of Curriculum System for Computer-Related Majors Under the Background of New Engineering. *Computer Education* 2023; (**12**): 319–324.

13 Li TT, Zhu JJ. The Internal Mechanism and Path Optimization of AI-Driven Personalized Learning for Students. *Teaching & Administration* 2026; (**09**): 63–67.

14 Gesang Y, Zaxi G. Research on Personalized Learning Management Strategies for College Students Based on Artificial Intelligence. *Journal of Jiamusi Vocational Institute* 2026; **42**(**01**): 194–196.

15 Li D. Core Analysis of the Research on the Construction of Dual-Qualified Teacher Team in Computer Science. *China New Telecommunications* 2022; **24**(**02**): 163–164.

16 Hu GH, Zhao QS. Exploration of the Practical Teaching Mode of School-Enterprise Cooperation for Computer Science Majors in Local Applied Undergraduate Colleges. *Computer Knowledge and Technology* 2019; **15**(**29**): 184–185.