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An Exploration of Talent Cultivation Strategies for Electronic Information Disciplines in Higher Education Institutions from the Objective of Practical Innovation Capabilities

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Abstract: *With the rapid advancement of emerging technologies such as artificial intelligence, big data, and the Internet of Things, a significant generational gap has emerged between the existing engineering education system and the dynamic demands of industry. Society's need for innovative and entrepreneurial talent is growing daily, and the cultivation of such talent plays a crucial role in driving national development. How to deepen the cultivation of innovative talent has become a critical challenge for higher education institutions. Therefore, this paper takes this as its starting point. Based on an analysis of the current state and common issues in cultivating innovative talent at local universities, it proposes solutions across six dimensions: fostering virtue through education, collaborative education models, curriculum systems, practical training, and quality assurance development. These approaches aim to advance the cultivation of innovative talent.*

Keywords: *Practical Innovation Capability; Electronic Information Disciplines; Talent Cultivation Strategies*

1. Introduction

Practical innovation serves as the core engine of social progress and the pivotal pillar underpinning national prosperity and economic advancement. Amidst the strategic blueprints of 'Made in China 2025', 'Internet Plus', and the 'Belt and Road Initiative', the surging tide of the new economy demands diverse, innovative information professionals to chart the course for the future. Therefore, higher education institutions should leverage their unique strengths to deepen reforms in information-related professional education, exploring diversified and multi-dimensional educational pathways. This necessitates not only strengthening students' scientific foundations and engineering practice capabilities but also comprehensively enhancing their overall quality. The aim is to cultivate innovative talents who can both respond to the nation's developmental call and lead the forefront of international science and technology. The cultivation of innovative talent is not only an urgent necessity for socio-economic development but also a strategic imperative for accelerating the pace of the new industrial era and enhancing national competitiveness. It holds immeasurable practical significance and profound implications.

2. Analysis of the Current State of Talent Cultivation in Electronic Information Disciplines at Higher Education Institutions Under the Objective of Practical Innovation Capability

2.1 Optimisation of Disciplinary Structure Requires Enhancement

Presently, the disciplinary structures of electronic information programmes at many higher education institutions have not fully kept pace with the speed of industrial technological iteration, exhibiting certain lagging and homogenisation phenomena. This is primarily manifested in the following aspects: Firstly, disciplinary development lags behind technological trends. The pace of updating disciplinary directions and curriculum systems is slower than the advancement of industry technologies. Much course content remains focused on classical theories and technologies, with

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insufficient depth and systematic coverage of cutting-edge interdisciplinary fields. This creates a 'time lag' between students' learning and industry demands. Second, programme offerings exhibit convergence with insufficient distinctive features. Numerous institutions offer programmes such as Electronic Information Engineering, Communication Engineering, and Microelectronics with remarkably similar training plans and curricula, lacking precise alignment with their institutional strengths or regional industrial characteristics. This results in graduates possessing homogeneous knowledge structures, lacking core competitiveness in the job market, and failing to meet the specialised talent demands of niche sectors and distinctive industries. Thirdly, disciplinary barriers persist, hindering cross-disciplinary integration. Electronic information itself is a field deeply intertwined with computer science, automation, physics, materials science, and even biomedical engineering. However, administrative barriers between faculties and departments within universities create significant obstacles to cross-disciplinary course design, faculty sharing, and collaborative projects. Students struggle to access and integrate knowledge from other disciplines, limiting their capacity to tackle complex systems engineering problems and pursue original innovation.

2.2 Practical and Innovative Capabilities Require Further Enhancement

The tendency to prioritise theory over practice remains the most criticised aspect of current talent cultivation, with no fundamental reversal achieved. Many institutions lack effective articulation and progression between practical components, failing to establish a systematic competency development chain spanning the entire undergraduate programme. Laboratory sessions predominantly feature verification-based or demonstration experiments, where students follow procedures without scope for independent design or exploration. Although initiatives like the 'Undergraduate Innovation and Entrepreneurship Training Programme' are now widespread domestically, they often benefit only a select few outstanding students rather than the entire cohort. For the majority of students, there is a lack of sustained, institutionalised training in innovative thinking and project-driven learning experiences. The integration of innovation activities with coursework remains weak, often rendering such initiatives an additional burden. Furthermore, the prevailing student assessment system continues to rely primarily on examination results as the benchmark, lacking scientific and effective evaluation methods for students' performance in project practice, teamwork, and innovative thinking.

2.3 Expanding the Depth and Breadth of University-Industry Collaboration

University-industry collaboration represents a crucial pathway for bridging the gap between theory and practice while enhancing students' engineering capabilities. However, current cooperation models predominantly remain superficial. Collaboration formats remain limited, characterised by isolated, ad hoc arrangements. The most prevalent form involves short-term production placements or observational visits prior to graduation. Such collaborations are fleeting and superficial, hindering systematic knowledge and skill transfer from enterprises to students. Students likewise cannot engage deeply in authentic corporate R&D or production processes. Even when universities demonstrate strong willingness to collaborate, enterprises often exhibit low initiative and enthusiasm for deeper partnerships due to concerns over technical confidentiality breaches, potential impacts on production efficiency, increased management costs, and unclear returns on investment. Furthermore, the absence of long-term mechanisms for joint establishment and management has resulted in few successful cases of deep collaboration in areas such as co-building industry colleges, jointly offering courses, or co-supervising graduation projects. Where collaboration does occur, projects or topics provided by enterprises often fail to align with the university's teaching schedules and knowledge frameworks. Consequently, cutting-edge industrial technologies, real-world case studies, and engineering standards cannot be effectively transformed into high-quality teaching resources and systematically integrated into daily instruction[1].

3. Practical Exploration of Talent Cultivation in Higher Education Electronic Information Disciplines Under the Objective of Practical Innovation Capabilities

3.1 Promoting the Organic Integration of Ideological and Political Education with Talent Development

Whilst imparting knowledge and cultivating abilities, integrate core socialist values into the curriculum system. Using 'value-led education' as the entry point, we should establish progressive

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teaching objectives that prioritise moral education. With the shaping of socialist labour values as the foundational objective, we aim to achieve the goal of consciousness cultivation; we should strengthen teamwork and work ethic among contemporary university students to cultivate spiritual development; we ought to foster integrity, responsibility, and other essential qualities for innovation and entrepreneurship to develop practical capabilities. We guide students towards establishing correct worldviews, outlooks on life, values, and concepts of honour and disgrace, thereby fulfilling the fundamental mission of fostering virtue through education. Consequently, teaching designs should centre on this core principle, integrating physical education, aesthetic education, and labour education into talent development programmes.

3.2 Establishing a 'Five-in-One' Collaborative Education Model

Higher education institutions should align with national and regional socio-economic development needs.We by integrating employer requirements, corporate guidance, and collaborative implementation of talent cultivation plans with practical application through partnerships between universities and research institutes, a comprehensive 'five-in-one' collaborative education chain is formed, encompassing government, industry, academia, research, and application, as show in Figure 1:

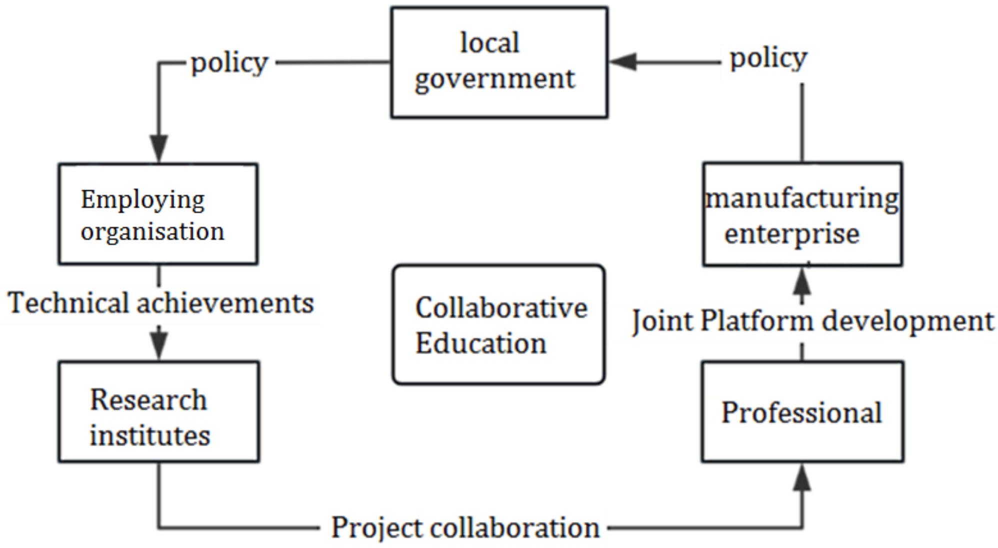

Figure 1 Five-in-One Collaborative Education Model

The government provides policy guidance and physical spaces for university-enterprise collaboration through industrial policies, talent programmes, collaborative innovation centres, and university science parks. It may issue regional challenges in public welfare and industrial technology to university-enterprise joint teams via competitions or open calls, enabling students to tackle genuine regional development issues. Universities should seek to establish framework agreements with industry-leading enterprises to build stable off-campus practice bases and collaborative training mechanisms. This provides students with opportunities for practical training, integrates industry mentors into the training system, and enriches the practical teaching content within training programmes. Timely conversion of faculty research outcomes into teaching case studies, comprehensive experiments, or seminar topics ensures students engage with the latest scientific discoveries and technological advancements. Undergraduates should be encouraged to participate in faculty research projects at national or provincial/ministerial-level key laboratories at an early stage. This not only hones students' research capabilities but also represents the most effective pathway for cultivating innovative thinking and scientific literacy. Enterprises should embed real-world projects and cutting-edge technologies—such as Huawei's ICT technologies or ARM's chip design—into senior-year curricula or summer terms through 'micro-majors' or 'project-based courses'. Research projects should be integrated with high-level academic competitions like 'Internet Plus', the Challenge Cup, and electronic design contests, using competitions to drive learning and research to foster innovation[2].

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3.3 Innovating Practical Training Models to Establish a Multi-tiered Competency Development Framework

Under the new engineering education paradigm, we are reshaping the practical teaching system. Centred on enhancing engineering problem-solving capabilities, fostering innovation and entrepreneurship spirit, and cultivating scientific research literacy, we are revolutionising the practical teaching framework. This involves optimising the structure, enriching content, innovating delivery methods, and strengthening hands-on application and exploratory learning. These measures lay a solid foundation for students' holistic development, as illustrated in Figure 2. Phase One involves foundational training, where students complete core course experiments to establish groundwork for software and hardware development. Phase Two entails participation in diverse research training projects, including the Electronics Society's research training and innovation-entrepreneurship initiatives, as well as faculty research conversion programmes. Phase Three transforms top-tier academic competitions into crucibles for practical innovation. Employing task-driven pedagogy, students treat these competitions as real-world stages, immersing themselves autonomously in practical exploration. Project-driven motivation ignites intrinsic innovative potential, accelerating the transition from theoretical knowledge to practical skills. The fourth stage sees deepened university-industry collaboration, with both parties jointly establishing an innovation training platform that deeply integrates industry, academia, and research. This effectively enhances students' innovative awareness and problem-solving skills, laying a solid foundation for cultivating the innovative, practice-oriented elites required by future society[3].

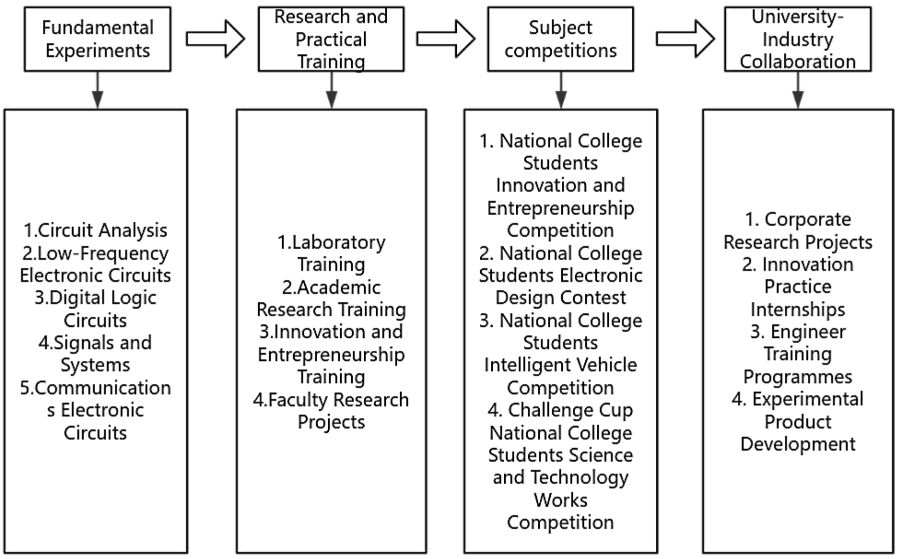

Figure 2 Comprehensive Tiered Innovation Practice Development Framework

Higher education institutions should leverage their Innovation Capability Training Centres and Innovation Incubation Centres to design specialised innovation and entrepreneurship projects, actively organising students to participate in various innovation and entrepreneurship competitions to facilitate the transition of innovative projects into start-ups. They should provide makerspaces, incubation bases and other facilities to support student innovation and entrepreneurship, establish robust support systems, actively attract social resources such as entrepreneurial mentors and venture capital, build platforms connecting student innovation and entrepreneurship projects with society, and foster a favourable environment for innovation and entrepreneurship. Higher education institutions should encourage students to actively participate in innovation and entrepreneurship training programmes, subject competitions, scientific research, invention and creation, academic exchanges, and other activities. Credit recognition should be granted for such participation, with awards given to winning students and their supervisors. The guidance of students in extracurricular subject competitions and university innovation and entrepreneurship practice activities should be included as a key component in the comprehensive evaluation of teaching quality for faculty members. Higher education institutions should develop a comprehensive innovation and entrepreneurship education curriculum system accessible to all students. This system should encompass compulsory and elective modules covering research methodology, cutting-edge disciplinary developments, foundational entrepreneurial theory,

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and practical guidance on employment and entrepreneurship. Concurrently, dedicated online platforms for innovation and entrepreneurship education should be established to enrich digital educational resources. Institutions should meticulously curate and independently develop a series of high-quality online open courses, including MOOCs and video lectures. This multi-faceted approach aims to stimulate students' innovative thinking and entrepreneurial potential.

3.4 Establishing Multi-Party Collaborative Innovation Platforms

Develop a student-centred, integrated teaching system for innovation and entrepreneurship that combines academic and practical learning, fostering multi-party collaboration among industry, academia, research institutions, and end-users. We build collaborative innovation platforms centred on professional talent development objectives and the requirements of new engineering disciplines[4].

(1) Diversified Collaborative Platform Development. Higher education institutions should establish long-term, stable partnerships with enterprises, research institutes, government departments, and other stakeholders. We through jointly established laboratories, R&D centres, and industry-academia colleges, provide students with internship opportunities and access to research projects. Invite corporate experts and industry leaders to participate in teaching to ensure students master cutting-edge technologies and practical operational skills.

(2) Seamless Integration of Teaching and Practice. We emphasise combining theoretical knowledge with practical application through case-based teaching and project-driven methodologies to help students comprehend and apply acquired knowledge. Practical platforms should encompass both on-campus and off-campus training bases, innovation and entrepreneurship workshops, and other facilities to provide students with abundant hands-on opportunities, thereby enhancing their ability to solve real-world problems[5].

(3) Shared Innovation Resources and Commercialisation of Outcomes. We establish a shared innovation resource repository, including experimental equipment, research data, and literature resources, for joint use by faculty and students. Create mechanisms for commercialising outcomes, transforming innovative achievements into tangible products or services to drive the market application of scientific and technological advancements. Higher education institutions may establish innovation and entrepreneurship companies or incubators to provide students with entrepreneurial support and services.

Through the establishment of such multi-stakeholder collaborative innovation platforms, universities can fully leverage resource integration and synergistic effects, providing robust support for cultivating new engineering talent with international perspectives and innovative capabilities. This not only helps meet societal demand for high-calibre engineering and technological professionals but also provides crucial support for advancing institutional development and enhancing international competitiveness[6].

3.5 Enhancing the Quality Assurance System for Talent Development

In accordance with the requirements for cultivating practical innovation capabilities, explicit quality standards and evaluation mechanisms have been established for key components including educational objectives, graduation requirements, curriculum frameworks, course syllabi, and teaching processes[7]. Concurrently, by implementing a course quality evaluation system grounded in the Outcome-Based Education (OBE) philosophy and a mechanism for assessing the attainment of graduation requirements, regular evaluations of educational objectives and graduation requirement fulfilment are conducted. This provides a basis for the continuous improvement of the programme. Furthermore, emphasis shall be placed on integrating knowledge with innovation and entrepreneurship capabilities, enhancing the breadth and depth of specialised courses to cultivate higher-order thinking. During theoretical instruction, students shall be guided through discussions and case studies to apply acquired knowledge towards resolving complex engineering challenges, while encouraging exploratory innovative design. We expand the breadth of teaching content by strengthening the presentation of case studies on new developments, recent achievements, and exemplary innovation and entrepreneurship cases. This will help students understand the current state and future direction of the discipline, thereby stimulating their innovative thinking and imagination, and igniting their creative impulses and inspiration[8].

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4. Conclusion

National strategies, socio-economic developments, and industrial growth have imposed new demands upon electronic information education. Orienting towards societal needs and meeting industrial requirements have become fundamental directions for the development of new engineering disciplines. Compared to research-oriented universities, local institutions place greater emphasis on cultivating innovative talent for industry, strengthening systematic training in engineering practice. As primary providers of highly skilled, innovative applied professionals sought by industry, local universities should prioritise developing students' systematic engineering practical capabilities. Constrained by factors such as funding, student recruitment, and regional faculty resources, local universities must adapt to the demands for cultivating innovative practical abilities within the new engineering paradigm, addressing the associated challenges in teaching conditions for practical skills development. Only through holistic talent cultivation encompassing moral education, collaborative teaching models, practical training, and quality assurance systems can we forge future-oriented, internationally minded innovative professionals.

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