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Analysis of the Difficulties Faced by the Training of Integrated Circuit Talents in Higher Vocational Education

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Abstract

This article, based on the education and educational reform research project of Suzhou Industrial Vocational and Technical College, deeply analyzes the difficulties faced by the integrated circuit major of Suzhou Institute of Technology in the cultivation and implementation of high-quality and high skilled applied talents from five dimensions: teacher allocation, practical links, curriculum connection, "three integration" coordination, and curriculum ideological and political education. At the end of the article, the reform direction of the "three integrations and coordination" talent training model for integrated circuits in vocational colleges is proposed, which has certain reference significance for the self analysis of the difficulties in talent training for integrated circuit majors in vocational colleges and the exploration of high-quality skilled talent training models in the field of integrated circuits in vocational colleges.

Keywords

Vocational colleges; Integrated circuit; Dilemma

1. Introduction

Integrated circuits in the field of high-end design and manufacturing are the core of industrial modernization based on information technology. The integrated circuit industry, encompassing design, fabrication, packaging, and testing, spans numerous sectors such as IT, military, and consumer electronics, holding a foundational, pioneering, and strategic position in national economic and social development[1-2]. The current Sino-US trade friction, particularly the US's aggressive suppression and continuous technological blockade against China's high-tech enterprises, has placed the integrated circuit industry in a predicament of multiple challenges amidst both internal and external troubles. Meanwhile, under the backdrop of "Emerging Engineering Education" and the "Grand Vocational Education Perspective," the curricu-

lum design, talent cultivation models, and the construction, development, and refinement of the modern vocational education system in vocational colleges must adapt to the times to sustainably advance the process of Chinese-style modernization and realize the great rejuvenation of the Chinese nation.

Suzhou Vocational Institute of Industrial Technology began preparations to establish the Integrated Circuit Application Technology program in 2019. Currently, the program is affiliated with the Department of Electronics and Communication Engineering (one of the eight teaching departments established by the institute, with its origins tracing back to the Jiangsu Advanced Industrial Vocational School founded in 1946). The program officially enrolled students in 2021, and as of September 2023, it has admitted three cohorts, comprising a total of 7 classes and 294 students. As a newly established program at the institute, it benefits from the national push to vigorously develop the chip industry. However, it also faces challenges that cannot be ignored or avoided.

2. Uneven distribution of faculty resources

The key points that vocational colleges need to consider in terms of balanced teacher allocation are as follows: 1.Professional distribution - ensuring that each major has sufficient quantity and quality of teachers; 2.Discipline structure - the number of teachers in each discipline should be relatively balanced, and the allocation of teachers for basic disciplines, professional core courses, and elective courses should be reasonable; 3.Professional title structure - the proportion of teachers with senior, intermediate, and junior professional titles should be reasonably distributed. Teachers with senior professional titles should be distributed in key courses and core majors to ensure teaching quality and research level Educational structure - The proportion of teachers with a master's degree or above should reach a certain standard, especially in key courses and important majors. Schools should encourage and support teachers to continue their education and improve their educational level The proportion of dual qualified teachers - vocational colleges should have a certain proportion of "dual qualified" teachers, who should be reasonably distributed in practical majors and courses to enhance students' practical abilities Teacher age structure - There should be both experienced senior teachers and dynamic young teachers in the teaching team, ensuring the inheritance of teaching experience and innovation ability through reasonable age echelon construction;7.Teaching and research - both teachers' teaching ability and research ability should be valued, and teaching and research tasks should be reasonably allocated Teacher Training and Development - Schools should provide balanced training and development opportunities to help all teachers improve their professional abilities and teaching levels.

3. Insufficient configuration in the practical session

The key elements of vocational practical education are as follows:1.Experimental

teaching - setting courses covering both basic and professional experiments according to professional needs; Construct and improve laboratories, provide modern experimental equipment and environment, and ensure the smooth progress of experimental teaching Practical teaching - building on campus training bases to provide practical places that simulate real work environments; Reasonably arrange practical training courses to enable students to fully engage in practical training during their school years; Equipped with experienced teachers to guide practical training, ensuring that students master practical operational skills Off campus internship students conduct on-the-job internships before graduation, directly participating in enterprise production or service work, and accumulating practical work experience; Hire enterprise experts as student mentors to guide students' learning and work in the enterprise; Collaborate with enterprises to carry out project-based teaching, allowing students to learn and grow through practical projects Vocational Skills Competition - Organizing on campus vocational skills competitions to enhance students' practical abilities and competitive awareness; Encourage and support students to participate in various levels and types of vocational skills competitions, showcasing and enhancing their skill levels Entrepreneurship education and practice - offering entrepreneurship foundation courses to impart entrepreneurial knowledge and skills; Establish entrepreneurial incubation bases, provide entrepreneurial practice platforms and resource support; Invite successful entrepreneurs and entrepreneurial mentors to guide students in their entrepreneurial projects.

4. Disorder before and after course transition

Vocational education curriculum linkage refers to the organic connection and coordination of courses at different stages and levels in the vocational education system, ensuring that students can gradually deepen their knowledge and skills during the learning process, and smoothly transition to higher-level learning or vocational positions. The curriculum content of vocational and secondary vocational education should be closely linked, and secondary and vocational schools should jointly develop teaching plans to ensure consistency in curriculum design, teaching progress, and assessment standards. A credit recognition mechanism should be established between secondary and vocational schools to reduce the burden of repetitive learning; According to the needs of the enterprise, courses are set up, and practical activities are closely integrated with the actual operations of the enterprise. Through practical training, internships, and other methods, students are able to master practical operational skills; Introduce enterprise experts as part-time teachers, or dispatch teachers to enterprises for training, to establish a "dual teacher" teaching team with both theoretical knowledge and practical experience; Embedding the content of vocational qualification certification exams into daily teaching, the course content should comply with national or industry vocational standards, so that students can directly participate in vocational qualification certification exams after

completing their studies; Provide opportunities for continuing education for employees, design blended learning courses that combine online and offline teaching, so that they can continue to improve their education and skills in their spare time; The course content is divided into several modules, each of which is independently organized into chapters, and the modules are organically connected to enable students to flexibly choose their learning paths; Core courses provide essential professional knowledge and skills, while elective courses offer diverse learning content based on students' interests and career development needs; According to the demand for composite talents in modern vocational positions, interdisciplinary courses are set up to enable students to master various knowledge and skills; Pay attention to the correlation and complementarity between disciplines in course design, and avoid the isolation and segmentation of course content. Through the integration of the above aspects, vocational education courses can form a coherent and systematic teaching system, enabling students to gradually improve their knowledge and skills during the learning process, smoothly adapt to the needs of vocational positions, and achieve personal career development goals.

5. Imbalance in the coordinated cooperation of the "three integrations"

Compared to traditional electronic information professional clusters, the establishment time of integrated circuit majors is shorter, and the talent training model of "three integrations" collaboration lacks existing experience and practices for reference. The technology progress and iteration in the integrated circuit industry are rapid, and there is a gap between the professional course content and the mainstream process flow in the industry; Excellent professional teachers from schools conduct in-depth visits to enterprises for work and practical experience, while senior technicians from enterprises are limited by policies and often unable to flexibly carry out on campus part-time teaching, resulting in practical implementation; The appointment of industry professors and the hanging of high-level talents as vice presidents of science and technology in schools are still in the initial exploration stage... The direct consequence is that there is a disconnect between the training system of vocational colleges and the talent demand of industries and enterprises, which leads to the integration of industry and education. Universities collaborate with industry and academia to access cutting-edge technologies and processes in the industry, enhancing the engineering skills and abilities of talents; Enterprises promote products and technologies, cultivate and select reserve human resources, and develop new technologies and products; The win-win path is not yet clear, the mechanism of school enterprise cooperation is unclear, and the responsibilities and rights are unclear. Vocational colleges often establish multi-level and multi form school enterprise guidance committees, but there is a lack of deep participation from enterprises in the formulation of talent training plans, development of class-

room teaching scenarios, compilation of school-based textbooks, engineering alternation training, and on-the-job internship guidance[3]. Therefore, colleges cannot respond to the practical needs of enterprises for vocational college graduates in a timely manner, and talent cultivation lacks characteristics. As a high-end precision manufacturing industry, integrated circuits are difficult for vocational colleges to independently achieve talent training goals without high-level training and scientific research verification platforms. The integration mechanism of science and education, which involves introducing enterprise funds and technology, jointly building a platform for industry university research and application, conducting basic research, and collaborating on research and development innovation, is still in its early stages and cannot fully and quickly meet the corresponding talent training needs. The demand for talent in the integrated circuit industry has a high level of education, with a low proportion of practitioners below vocational (associate) level. It is difficult to find a vocational (or equivalent) school that offers integrated circuit majors. The majority of students in our integrated circuit single recruitment class come from nearby majors such as electronics and communication, and there is a lack of professional knowledge and skill reserves in the integrated circuit industry; The professional construction time is short, and the teaching staff, software and hardware configuration, and achievements are not sufficient to support the application for undergraduate majors; The number of graduates from vocational colleges (junior colleges) is insufficient, and measures such as teacher and venue sharing, credit and course exchange, mutual recognition of student management and assessment mechanisms, and joint training of integrated circuit talents in undergraduate colleges are still in the exploratory stage. There is a long way to explore in the integration of vocational and general education.

6. Lack of ideological and political case studies in the curriculum

The implementation of ideological and political education in the curriculum requires teachers to be educators, role models, and communicators. While imparting knowledge during the teaching process, they should also understand the ideological dynamics and needs of students, and guide and educate them through words and deeds; To combine the characteristics of the discipline and integrate elements of ideological and political education into the teaching of professional knowledge, typical cases should be used to vividly carry out ideological and political education; Integrating ideological and political education with specific project tasks, adopting interactive teaching methods such as discussion, debate, and role-playing, and simulating real situations to allow students to experience and think in specific situations, thus improving the effectiveness of ideological and political education. Provide professional training related to ideological and political education for teachers to enhance their ability and level of ideological and political education; Organize teachers to carry out experience exchange, share the implementation experience and teach-

ing methods of ideological and political education in the curriculum; Develop and promote textbooks and teaching reference books that integrate ideological and political education content, and provide abundant teaching resources; Establish a curriculum ideological and political information platform, provide high-quality educational resources and teaching cases, and support teachers' teaching work; Incorporate ideological and political education into the evaluation and assessment system for teachers, and motivate them to actively participate in the construction and implementation of ideological and political education in the curriculum; Develop and implement relevant policies to provide policy guarantees and support for the implementation of ideological and political education in the curriculum.

In the context of the era of "new engineering", the cultivation of integrated circuit professionals in higher vocational education needs to closely follow the development of the national chip strategy, starting from the technological updates and talent demand of the entire industry chain, fully leveraging the characteristics and advantages of the colleges themselves, and breaking through the current difficulties faced by talent cultivation with the concept of "three integrations" synergy.

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