

Research on the New Mode of "Double-Qualified " Teaching Team Construction of Integrated Circuit Specialty under the Background of Integration of Production and Education

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Abstract: Based on the background of the integration of production and education, this paper focuses on the construction of "double-qualified " teaching team of integrated circuit specialty in higher vocational colleges. By analyzing the current development of integrated circuit industry and the characteristics of talent demand, this paper combs the problems and challenges of the existing teaching team construction, puts forward a new mode of "double-qualified" teaching team construction of "one core, two wings and three integration", and explores the systematic implementation path and guarantee mechanism. The research shows that this model effectively improves the professional ability and teaching level of teachers, promotes the deep integration of production and education, and provides strong support for the cultivation of high-quality integrated circuit technical talents. This study provides new ideas and practical experience for the construction of 'double-qualified' teaching team of integrated circuit specialty in higher vocational colleges.

Keywords: Integration of Industry and Education; Integrated Circuit Professional; Double Teacher Type; Teaching Team; Construction Mode.

1. Introduction

The integrated circuit industry is a national strategic and basic industry; it is the core of the information technology industry. With the rapid development of China's integrated circuit industry and the prominent technical problems, the training of high-quality integrated circuit professionals has become particularly important. The "National Integrated Circuit Industry Development Promotion Outline" clearly states that it is necessary to strengthen the construction of integrated circuit-related disciplines and personnel training. The "National Vocational Education Reform Implementation Plan" emphasizes the need to build a high-quality "double-qualified" teacher team. In 2022, the Ministry of Education and other six departments jointly issued the "Several Opinions on Strengthening Organized Scientific Research in Colleges and Universities to Promote the High-quality Development of Integrated Circuits, Software and Computing Power Industry", which further emphasized the important role of colleges and universities in the cultivation of integrated circuit talents.

The integration of industry and education is the basic school-running mode of vocational education and the only way to cultivate high-quality technical and skilled talents. Under the background of the integration of production and education, the construction of 'double-qualified' teachers has become a key link to improve the quality of vocational education. The integrated circuit specialty has the characteristics of fast technological renewal, strong practicality and interdisciplinary integration, and has higher requirements for 'double-qualified' teachers. The traditional teacher individual training mode has been difficult to adapt to the talent training needs under the new situation. Therefore, it has become an important issue in the current vocational

education reform to explore the construction of a new mode of "double-qualified" teaching team construction for integrated circuit specialty.

2. Research Background and Problem Analysis

2.1. Integrated Circuit Industry Development and Talent Demand

In recent years, China's integrated circuit industry has maintained rapid growth. According to the statistics of China Semiconductor Industry Association, the sales of China's integrated circuit industry reached 1146.6 billion yuan in 2022, an increase of 6.7% year-on-year. According to the forecast of China Electronic Information Industry Development Research Institute, the talent gap of China's integrated circuit industry will exceed 300,000 people in the next five years. The demand for talents in the integrated circuit industry presents the following characteristics: (1) The demand for compound talents is prominent. There is a shortage of compound talents who are proficient in professional knowledge and understand the actual situation of the industry, and have the cognitive ability of the whole process of design, manufacturing, packaging and testing. (2) High requirements for technological innovation ability. With the rapid iteration of integrated circuit technology, the requirements for talents' innovation ability and ability to solve practical problems are increasing. (3) Shortage of talents in industrial chain collaboration. Talents who can understand and coordinate the upstream and downstream industrial chain links and promote collaborative innovation in the industrial chain are in short supply. (4) Practical ability requirements are prominent. Enterprises pay more attention to the practical ability and project experience of talents, and the practical

ability requirements of graduates are constantly improving.

2.2. Current Situation and Problems of Integrated Circuit Professional Teaching Team

Through the investigation of higher vocational colleges offering integrated circuit specialty in China, it is found that the current construction of 'double-qualified' teaching team of integrated circuit specialty has the following problems: (1) The professional background of teachers is out of touch with the industrial demand. Some teachers come from electronics, computers and other related majors, and they do not have a systematic grasp of the core knowledge of integrated circuit specialty, and they do not have enough understanding of the latest developments of industrial development. (2) The number of 'double-qualified' teachers is insufficient. The proportion of teachers with practical experience in enterprises is low, and teachers who truly meet the 'double-qualified' standards are scarce, and it is difficult to meet the needs of professional construction. (3) The depth of teachers' enterprise practice is not enough. Teachers' enterprise practice mostly stays at the level of visit and short-term training, lacks the opportunity to deeply participate in the actual project of the enterprise, and the improvement of practical ability is limited. (4) The teaching team cooperation mechanism is not perfect. The professional division of labor among teachers is insufficient, the school-enterprise cooperation is loose, and there is a lack of systematic and normalized collaborative education mechanism. (5) The lack of motivation for teachers' professional development. The teacher evaluation mechanism is single, the weight of enterprise practice experience in the title evaluation is low, and the enthusiasm of teachers to improve their practical ability is not high.

3. The Construction of "Dual-Qualified" Teaching Teams

3.1. The Theoretical Basis of 'Double-Qualified' Teaching Team Construction

3.1.1. Team Building Theory

Team building theory holds that efficient teams should have clear goals, complementary skills, common responsibilities and coordinated actions. As a special form of organization, the teaching team needs to form a good ecology of complementary advantages, resource sharing and collaborative innovation among members [1].

3.1.2. Collaborative Innovation Theory

The theory of collaborative innovation emphasizes the optimal allocation of resources and the improvement of innovation efficiency through the organic coordination of multi-agent and multi-factor. In the construction of "double-qualified" teaching team, it is necessary to form a multi-collaborative innovation mechanism through school-enterprise collaboration, school-school collaboration and teacher-to-teacher collaboration [2].

3.1.3. The Theory of Practical Community

The theory of community of practice emphasizes the promotion of professional growth and knowledge co-construction of members through common practical activities and experience sharing. The 'double-qualified' teaching team can be regarded as a professional practice community, which can promote the professional development of teachers by participating in practical projects and solving practical

problems [3].

3.1.4. The Theory of Integration of Industry and Education

The theory of integration of industry and education advocates the deep integration of education and industry, and realizes the precise docking of talent training and industrial demand. In the construction of 'double-qualified' teaching team, it is necessary to deeply integrate industrial elements into the whole process of teacher development and team building [4].

3.2. Construction of a New Model for the Construction of 'Double-Qualified' Teaching Team in Integrated Circuit Specialty

3.2.1. The General Idea of Model Construction

Based on the above theoretical analysis and problem diagnosis, this study proposes a new model of "double-qualified" teaching team construction of integrated circuit specialty with "one core, two wings and three integrations":

'One core': taking the integration of industry and education as the core, integrating industrial demand, enterprise practice and engineering project into the whole process of teaching team construction.

'Two wings': taking the development of professional teachers and the introduction of enterprise talents as the two wings, to create a structure of teachers with full-time and part-time combination and complementary advantages.

'Three integration ': promote the integration of school and enterprise, the integration of theory and practice, the integration of teaching and research, and build a multi-coordinated teaching team development ecology.

3.2.2. The Specific Architecture of the Model

(1) Team Organization Structure

Build a 'pyramid' team organization structure:

Top layer: the core layer of the team composed of professional leaders and enterprise technical experts, responsible for team development planning and major decisions.

The middle level: a team executive layer composed of backbone teachers and enterprise backbone engineers, responsible for the implementation of specific projects and teaching reform.

Grassroots: a team support layer composed of young teachers and part-time teachers in enterprises is responsible for daily teaching and project practice.

(2) Role positioning of team members

Professional leaders: grasp the direction of professional construction, coordinate school-enterprise resources, and lead team development.

Key teachers: leading curriculum construction and teaching reform, participating in enterprise project practice, and promoting technology transformation.

Young teachers: undertake teaching tasks, actively participate in enterprise practice, and quickly improve the ability of 'double teachers'.

Enterprise technology experts: provide industry dynamics and technology frontier information, participate in professional planning and curriculum design.

Enterprise engineers: Participate in practical teaching, guide students' projects, and share engineering experience

(3) Team function orientation

Talent training function: to undertake the teaching task of

integrated circuit specialty and cultivate high-quality technical and skilled talents.

Teaching research function: carry out teaching reform research, develop curriculum resources, and optimize teaching methods.

Technical service function: Provide technical services to enterprises, solve practical problems, and promote the transformation of results.

Social training function: to carry out enterprise staff training and social personnel training, to serve the development of integrated circuit industry.

3.2.3. Main Features of the Model

Deep integration of industry and education: integrate industrial demand and enterprise elements into the whole process of team building, and realize the organic connection between education chain and industrial chain.

School-enterprise collaborative education: build a teaching team with the participation of school teachers and enterprise experts, and form a collaborative education mechanism.

Advantage complementary sharing: give full play to the advantages of both schools and enterprises, and realize the complementary sharing of resources such as talents, technology, projects and platforms.

Dynamic openness and inclusiveness: maintain the openness and inclusiveness of the team, and dynamically adjust the team structure according to industrial development and teaching needs.

Systematic support guarantee: Establish a sound system guarantee, resource support and evaluation incentive mechanism to promote the sustainable development of the team.

3.3. The Implementation Path of the New Model of 'Double-Qualified' Teaching Team Construction

3.3.1. School-Enterprise Co-Construction of 'Double-Qualified' Teacher Training Base

Co-construction practice base: Co-build a 'double-qualified' teacher training base with leading enterprises to provide a systematic practice platform for teachers.

Project-based training: using project-based training mode, teachers can improve their engineering practice ability by participating in actual projects of enterprises.

Regular rotation mechanism: establish a regular rotation mechanism for teachers to enterprises, and arrange 3-6 months of enterprise practice every year to ensure that teachers understand the dynamics of industrial development in a timely manner.

Technology R&D center: School-enterprise co-construction of integrated circuit technology R&D center, teachers participate in R&D projects to enhance technological innovation capabilities.

3.3.2. Construction of Diversified Enterprise Talent Introduction Mechanism

Flexible talent introduction mode: adopt the flexible talent introduction mode of 'not seeking all, but seeking use' to attract enterprise technical experts and engineers to join the teaching team.

Industry professor system: hire leading figures in the integrated circuit industry as 'industry professors' to participate in professional construction and talent training program formulation.

Engineer workstation: 'Engineer workstation' is established

in the school, and enterprise engineers enter the school regularly to carry out teaching and project guidance.

Two-way flow of talents between schools and enterprises: establish a two-way flow mechanism for teachers to work in enterprises and for enterprise personnel to teach in schools to promote talent exchange and integration.

3.3.3. Promote the School-Enterprise Collaborative Teaching Team Training System

Team training plan: Develop a hierarchical and classified teaching team training plan, and design differentiated training paths for different types and levels of teachers.

The "pass-help-lead" mechanism: establish a "pass-help-lead" mechanism for old, middle-aged and young teachers, and pair enterprise experts with young teachers to promote experience inheritance and rapid growth.

Project-driven training: taking the actual project as the carrier, forming a school-enterprise mixed team, and cultivating teachers' practical ability and teamwork spirit through the project implementation process.

International vision expansion: organize teachers to participate in international exchanges, overseas training and international certification, expand international vision, and understand the development trend of the global integrated circuit industry.

3.3.4. Build a Team Cooperation Mechanism Based on the Integration of Industry and Education

The construction of school-enterprise community: to build a 'professional construction community' and a 'teaching research community', and to form a working mechanism for deep cooperation between schools and enterprises.

Project team operation: the project team operation mode is adopted to form a special team around the tasks of talent training, curriculum construction and technical service.

Co-construction and sharing of resources: promote the co-construction and sharing of teaching resources, training equipment and technology platform, and improve the efficiency of resource utilization.

Information exchange mechanism: Establish a school-enterprise information exchange mechanism, and regularly carry out industrial development seminars, technology frontier sharing, and teaching and research exchanges.

3.3.5. Innovate the Evaluation and Incentive Mechanism of 'Double-Qualified' Teaching Team

Multi-evaluation system: construct a multi-evaluation system including teaching ability, practical ability, R&D ability and social service ability.

Special title evaluation: Establish a special title evaluation channel for 'double-qualified' teachers of integrated circuit specialty, and improve the weight of enterprise practice experience and engineering projects.

Performance distribution reform: deepen the reform of performance distribution system, establish a contribution-oriented incentive mechanism, and mobilize the enthusiasm of teachers to participate in the integration of production and education.

Team overall evaluation: pay attention to the overall performance evaluation of the team, establish an evaluation system combining team performance and personal performance, and promote the coordinated development of the team.

4. Conclusion and Prospects

The new mode of "double-qualified" teaching team

construction of "one core, two wings and three integration" integrated circuit specialty constructed in this study has realized the improvement of teachers' professional ability, the optimization of team structure and the improvement of talent training quality through the deep integration of production and education. The research shows that: firstly, the integration of production and education is the core concept and basic path of the construction of 'double-qualified' teaching team for integrated circuit specialty; secondly, school-enterprise cooperation and complementary advantages are the key factors to improve the quality of 'double-qualified' teaching team construction; thirdly, the systematic and institutionalized guarantee mechanism is an important support for the sustainable development of the teaching team; fourthly, the construction of 'double-qualified' teaching team should be closely combined with professional construction, curriculum reform and personnel training to form a coordinated development pattern.

In the future, the construction of "double-qualified" teaching team of integrated circuit specialty will face more opportunities and challenges. Looking forward to the future, we need to further deepen research and practice in the following aspects: (1) To explore the international development path of 'double-qualified' teaching team and enhance the international vision and cooperation ability of the team; (2) Strengthen the integration of teaching team and innovation and entrepreneurship education, cultivate students' innovative spirit and entrepreneurial ability; (3) Deepen the reform of the evaluation mechanism of the "double-qualified" teaching team and establish a more scientific and reasonable evaluation system; (4) Promote the coordinated development of the "double-qualified" teaching team of integrated circuit specialty and regional industrial clusters, and enhance the

ability to serve the transformation and upgrading of the industry; (5) Through continuous innovation and deepening practice, the construction of 'double-qualified' teaching team of integrated circuit specialty will provide more solid support for cultivating high-quality technical and skilled talents and serving the development of integrated circuit industry.

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