Education Insights

Article

Research on the Dynamic Adjustment of Specialties and the Construction Strategy of Characteristic Specialty Group of Hainan Vocational University of Science and Technology Driven by Regional Industrial Demand

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Abstract: As regional industrial structures undergo continuous restructuring and upgrading, the integration of vocational education with local industries has become increasingly vital for sustainable economic growth. Hainan Vocational University of Science and Technology, acting as a key contributor to the Hainan Free Trade Port (FTP) initiative, has proactively addressed regional industrial demands through dynamic program adjustments and distinctive specialty cluster development. This strategic alignment ensures that talent cultivation remains synchronized with the evolving "3+1" modern industrial system, which is central to the region's economic transformation. This study examines the current status and trends of industrial development in the Hainan Free Trade Port, evaluates the university's initiatives in establishing dynamic program adjustment mechanisms and planning specialized clusters, identifies critical implementation challenges, and proposes targeted optimization strategies. By emphasizing the transition from traditional vocational training to high-level undergraduate vocational education, the findings aim to provide actionable insights for the university and similar institutions in better serving regional industrial development, thereby fostering synergistic progress between vocational education and regional economies within a highly competitive and complex global trade environment.

Keywords: regional industrial demand; Hainan Vocational University of Science and Technology; dynamic adjustment of majors; construction of characteristic major groups

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1. Introduction

Against the backdrop of China's vigorous promotion of vocational education reform and development, the establishment and adjustment of academic programs in vocational undergraduate institutions have become pivotal factors influencing talent cultivation quality and regional economic service capabilities. As the nation shifts toward high-quality development and the cultivation of "new quality productive forces," vocational undergraduate education must bridge the gap between advanced theoretical knowledge and high-level technical application [1]. As a national strategic initiative, the Hainan Free Trade Port (FTP) development demonstrates vigorous industrial growth and unique demands, requiring a workforce that is not only technically proficient but also globally competitive. Rooted in local conditions and guided by regional industrial needs, Hainan Vocational University of Science and Technology actively explores dynamic program adjustments and distinctive program cluster development pathways, striving to align academic structures and talent cultivation models with regional industrial requirements [2]. However, practical challenges remain in accurately capturing evolving industrial demands, effectively integrating resources to build specialized program clusters, and

enhancing program-industry alignment. Therefore, the university's research in this field holds significant practical and theoretical value, providing a reproducible model for vocational undergraduate institutions to serve regional economic development while navigating the complexities of industrial upgrading [3].

2. Current Status and Demand Analysis of Industrial Development in Hainan Free Trade Port

2.1. Current Status of Industrial Development

In recent years, Hainan Free Trade Port has made remarkable progress in developing its "3+1" modern industrial system, encompassing tourism, modern services, high-tech industries, and tropical specialty agriculture [4]. The construction of an international tourism consumption hub has advanced steadily, with emerging tourism formats like cruise travel and duty-free shopping becoming significant economic pillars. Modern services sectors-particularly finance, trade, and shipping-have attracted numerous enterprises due to the free trade port's policy advantages, driving rapid growth in cross-border trade and offshore financial services. High-tech industries continue to expand in digital economy, biomedicine, and new energy fields, with many innovative enterprises taking root. Notably, the rapid development of the "Deep Sea Science and Technology City" and the "Commercial Space Launch Site" has created a specialized industrial ecosystem that demands highly sophisticated technical support. Tropical specialty agriculture has achieved breakthroughs in seed research and advanced processing of agricultural products, significantly enhancing the brand influence of local produce through the integration of smart farming technologies [5].

2.2. Characteristics of Talent Demand

The demand for professionals is highly diversified, spanning multiple sectors including tourism services, hotel management, financial investment, international trade, information technology, biomedicine, new energy technologies, and tropical agriculture. For instance, the rise of cross-border e-commerce has significantly increased the demand for versatile talents with expertise in cross-border trade, e-commerce operations, and foreign language proficiency. Meanwhile, the development of the new energy vehicle industry urgently requires professionals skilled in R&D, production, testing, and maintenance. This diversification necessitates a shift from narrow specialized training to a broader "interdisciplinary" talent cultivation approach that spans multiple technical domains [6].

The evolving demands for professional competencies now require not only solid technical expertise but also an international perspective, innovative thinking, cross-cultural communication skills, and digital literacy [7]. For instance, in international business, professionals must be well-versed in global regulations and trade procedures, while being adept at leveraging digital tools for market analysis and business expansion. Moreover, given the FTP's unique legal and tax environment, there is a growing need for "compliance-aware" technical talents who understand international arbitration and negative list management.

The demand is rapidly evolving. With the ongoing implementation of free trade port policies and the swift industrial upgrading, new industries and business models are constantly emerging, such as blockchain technology applications, AI services, and marine equipment manufacturing. This has led to a swift shift in talent demands, placing higher demands on the adaptability of academic programs and the flexibility of talent cultivation in educational institutions. Consequently, the university must transition from a reactive model of program adjustment to a proactive, forward-looking strategy that anticipates technological shifts before they become mainstream [8].

3. Construction of the Dynamic Adjustment Mechanism of Specialties at Hainan Vocational University of Science and Technology

3.1. Establishing an Industrial Demand Research Mechanism

A multidisciplinary research team was established under the leadership of the university's Academic Affairs Office, comprising academic leaders from secondary colleges, industry experts, and professional association specialists. The industry research group leveraged frontline technical expertise to identify skill requirements and technological trends, while association experts provided macro-level insights into industrial development and talent supply-demand dynamics. Faculty members conducted comprehensive data analysis to ensure thorough research. For instance, during the new energy sector study, industry professionals shared updates on battery technology upgrades and automation control talent needs, while association experts analyzed Hainan's national standing and future prospects in this field, offering multidimensional support for curriculum adjustments. This mechanism fosters a continuous "feedback loop" between the industrial front line and the classroom, ensuring that the competencies taught remain relevant to real-world applications [9].

We gather information through multiple channels, utilizing methods such as questionnaires, corporate visits, participation in industry forums, and big data analysis. Regular questionnaires are distributed to local enterprises in Hainan to understand talent demand and position requirements. At least 20 key enterprises are visited annually for on-site inspections of production and operational processes. We actively participate in industry forums to stay updated on the latest industrial policies and development trends. By leveraging big data technology, we analyze publicly available data from recruitment websites and industry reports to identify potential talent needs. By integrating qualitative insights from site visits with quantitative trends from big data, the university can construct a high-precision "talent demand map" that guides the strategic allocation of teaching resources [10].

3.2. Improving the Decision-Making Process for Professional Adjustments

The expert committee, comprising professionals from academic and industry sectors, corporate representatives, and educational administrators, is tasked with evaluating the necessity and feasibility of program adjustments. Upon receiving feedback from industry needs research, the committee conducts a comprehensive assessment of the proposed program's market prospects, employment trends, and institutional resources. For instance, when considering the establishment of a blockchain technology program, the committee analyzes its application scenarios in the Hainan Free Trade Port, talent shortages, faculty qualifications, and practical training facilities to provide expert guidance. The evaluation process employs a "multidimensional matrix" that balances economic demand with the university's long-term educational objectives [11]. A streamlined decision-making process is established to reduce unnecessary approval procedures. For urgent program adjustments driven by market demands, the committee's evaluation allows direct submission to the university leadership for final approval, thereby shortening the adjustment cycle and enabling the institution to swiftly respond to evolving industry needs.

3.3. Implementing Dynamic Professional Adjustment Strategies

The institution has phased out and restructured outdated academic programs, specifically those that fail to meet regional industrial demands, have low employment rates, or demonstrate subpar educational quality. For instance, the traditional marketing program was revamped to incorporate emerging fields like cross-border e-commerce and live-stream marketing, better aligning with the e-commerce industry's growth needs in the Hainan Free Trade Port. Meanwhile, programs such as resource exploration engineering were discontinued due to a sharp decline in demand resulting from Hainan's

industrial restructuring. The university has established a "yellow card" warning system for specialties with declining industry relevance, allowing for gradual withdrawal or transformation before pedagogical quality is compromised [12].

The university has introduced emerging disciplines in response to industrial development trends and market demands. Against the backdrop of the Hainan Free Trade Port's vigorous development of the digital economy, the institution has established specialized programs such as Artificial Intelligence Engineering Technology and Big Data Engineering Technology. Targeted talent cultivation plans have been formulated, with high-quality faculty and practical training resources allocated to address the urgent needs of industrial development. These new programs are not merely additive; they represent a fundamental shift toward "smart" vocational education, where digitalization is embedded into the core of every technical curriculum.

4. The Construction Practice of Specialized Professional Groups at Hainan Vocational University of Science and Technology

4.1. Planning and Layout of Professional Groups

Specialized program clusters aligned with industrial clusters: Centered around the Hainan Free Trade Port's "3+1" modern industrial system, multiple specialized program clusters have been established. For instance, the Computer Network Technology program cluster, covering disciplines such as computer network technology, software technology, and big data engineering, meets the demand for multi-level technical professionals in the digital economy. For tourism, the Cultural Tourism Product Creative Design program cluster integrates majors like art design, tourism management, and exhibition economy to cultivate interdisciplinary talents across the tourism industry chain. The fundamental logic behind this clustering is to achieve "economies of scale" in educational resources, where different majors share a common foundation of technical knowledge while maintaining distinct specialized pathways. Each cluster identifies a core program as the leader and supporting programs as pillars. In the Intelligent Manufacturing program cluster, the Mechanical Design and Manufacturing Automation program serves as the core, supported by disciplines like automation and mechatronics. These programs collaborate in curriculum design, faculty allocation, and practical training resources to form an integrated system that mirrors the structural complexity of modern industrial chains.

4.2. Professional Cluster Development

The curriculum reform is guided by industry job requirements, restructuring the course system to break traditional disciplinary boundaries and develop interdisciplinary comprehensive courses. In the Smart Tourism program, courses such as "Big Data Analysis and Application in Tourism" and "Smart Tourism Project Planning and Operations" integrate knowledge from tourism management and information technology. This curriculum architecture prioritizes "competency-based" learning, ensuring that students acquire the agility needed for high-end service sectors. The curriculum has been streamlined by eliminating outdated content and incorporating cutting-edge industry technologies and practical cases, ensuring alignment with real-world demands. Practical training bases are being expanded through increased investment and shared resources with enterprises. Collaborations include establishing software development training bases with Hainan Ecological Software Park and cruise service training bases with Sanya International Cruise Terminal. These bases are equipped with advanced facilities and simulated work environments, enabling students to participate in real corporate projects and enhance their practical skills. Furthermore, the university has promoted the "dual-teacher" model, encouraging faculty to obtain industry certifications and engage in joint technical R&D with corporate partners to bridge the gap between theory and practice.

5. Challenges and Issues

5.1. Professional Dynamic Adjustments

The response between industrial demands and academic program adjustments lags behind. Despite establishing research mechanisms, the process from information collection, analysis, and decision-making to program adjustments involves multiple stages and lengthy procedures, often causing delays in aligning academic offerings with industry needs. While the Hainan Free Trade Port's blockchain industry has grown rapidly, university programs in this field have lagged by 2-3 years, failing to meet enterprises' urgent demand for blockchain professionals. This structural friction stems from the mismatch between the relatively stable four-year educational cycle and the volatile cycles of emerging technology markets. The lack of long-term planning in program adjustments, coupled with an overemphasis on short-term market trends and insufficient analysis of industry development trends, has resulted in unstable program development and difficulty in establishing distinctive academic strengths. Some programs were hastily established during market peaks but quickly declined as market conditions changed, leading to the underutilization and wasteful allocation of instructional resources.

5.2. Development of Specialized Professional Clusters

The professional cluster demonstrates insufficient collaboration, with disciplines within the group lacking tight coordination in curriculum design, faculty sharing, and practical training resource utilization. Some courses contain redundant content, while institutional barriers hinder faculty sharing and prevent efficient sharing of practical training equipment, undermining the cluster's overall competitive edge. In the Intelligent Manufacturing professional cluster, overlapping content in courses like Mechanical Design and Manufacturing Automation and Automation's Mechanical Drawing and Control Principles leads to resource waste and low student engagement. Industry-education integration suffers from a "loose coupling" problem, where enterprises show insufficient motivation and depth in school-enterprise cooperation. Many companies only participate during student internships, with minimal involvement in core processes like curriculum development and talent cultivation planning, lacking sustainable collaboration mechanisms. Some enterprises avoid faculty participation in project development due to concerns about trade secret leaks or production disruptions, resulting in a superficial integration of industry and education that fails to reach the core of technological innovation.

6. Optimization Strategies

6.1. Professional Dynamic Adjustment and Optimization Strategy

To establish a rapid response mechanism for industrial demand, we will leverage big data and artificial intelligence technologies to build a real-time monitoring platform. This platform will capture and analyze information on talent requirements and technological trends in key industries of the Hainan Free Trade Port, providing timely and accurate data support for program adjustments. By shifting from retrospective analysis to predictive modeling, the university can identify "sunrise industries" before peak demand occurs. The process will be streamlined by granting secondary colleges greater autonomy in program adjustments. For adjustments with clear market demand, colleges may make independent decisions and file them with the university, thereby shortening the adjustment cycle and fostering a "grassroots-led" innovation environment.

Develop long-term professional development plans by organizing expert teams to conduct in-depth research on industrial development in the Hainan Free Trade Port. Aligning with the institution's educational positioning and strengths, formulate medium- and long-term development strategies for each discipline. Clearly define professional

development goals, pathways, and key focus areas to ensure the continuity and stability of disciplinary adjustments. This strategic foresight prevents "blind expansion" into saturated markets and ensures that every new major possesses a distinct competitive advantage. Strengthen forward-looking research on discipline development, proactively establish emerging disciplines, and cultivate talent reserves for future industrial growth to ensure the university remains a vanguard of vocational undergraduate education.

6.2. Optimization Strategies for Characteristic Professional Cluster Development

To enhance the collaborative development of academic clusters, we will coordinate curriculum system construction by establishing unified course standards and teaching plans at the cluster level. This involves integrating course content and developing interdisciplinary comprehensive courses. A resource-sharing platform will be established for academic clusters, including shared practical training equipment and faculty resources, to achieve unified allocation and efficient utilization of training facilities and instructors. This "modular" approach to resources allows for flexible reconfiguration as industrial priorities shift. An online reservation system will be implemented to facilitate access to practical training equipment for students across disciplines. A faculty sharing database will be created to encourage cross-disciplinary teaching by instructors and to break down traditional "disciplinary silos."

To strengthen the long-term cooperation mechanism between industry and education, we will establish a shared-interest mechanism and explore profit-sharing models for school-enterprise partnerships. By evolving from simple cooperation to a "Community of Shared Destiny," both parties can co-invest in high-end R&D centers. By offering tax incentives, financial subsidies, and intellectual property sharing, we aim to motivate enterprises to actively participate in talent development. Additionally, we will refine the evaluation system for school-enterprise collaboration, developing a scientific and reasonable assessment framework. This framework will comprehensively evaluate cooperation outcomes based on talent cultivation quality, enterprise satisfaction, and socio-economic benefits. Regular assessments will be conducted to ensure that the partnership transcends superficial internship agreements and reaches the core of collaborative technical innovation.

7. Conclusion

Driven by regional industrial demands, Hainan Vocational University of Science and Technology has actively implemented dynamic program adjustments and developed specialized discipline clusters, achieving notable progress while facing multiple challenges. By refining its dynamic adjustment mechanisms, enhancing specialized program clusters, and deepening integration with regional industries, the university is poised to cultivate more high-quality technical professionals aligned with the Hainan Free Trade Port's industrial needs. This evolution represents a significant milestone in the transition of vocational undergraduate education from a quantitative growth model to a qualitative, high-precision paradigm. Its innovative practices also serve as a valuable reference for other vocational undergraduate institutions, promoting better alignment between vocational education and regional industrial growth to achieve synergistic benefits. As the Hainan Free Trade Port continues to advance into a more complex stage of global integration, the university must maintain close attention to industrial trends, continuously innovate reforms, and strengthen its educational capabilities and service capacities. Ultimately, the success of this "Hainan Model" depends on the institution's ability to remain agile, evidence-based, and deeply rooted in the evolving industrial landscape of the digital era.

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