

Research on the Path of Cultivating High-Level Technical and Skilled Talents in Vocational Undergraduate Colleges and Universities

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Abstract: This paper explores strategies to cultivate high-level technical talents in vocational undergraduate colleges by analyzing their development, the essence of such talents, and proposing several key measures. Strategies include optimizing professional settings and curricula, enhancing school-enterprise cooperation and the integration of industry-university-research, improving teaching staff quality and educational standards, and expanding international cooperation. The importance of policy support and funding and establishing robust quality assurance systems is emphasized for effectively cultivating skilled talents in vocational undergraduate colleges.

Keywords: Vocational undergraduate colleges; High-level technical talents; Professional setting; Innovation and entrepreneurship education

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1. Introduction

With the rapid development of the social economy and the acceleration of scientific and technological progress, the demand for high-level technical and skilled talents is increasing. As an important platform for cultivating applied talents, vocational undergraduate colleges and universities are faced with the challenge of how to better adapt to and meet the diversified needs of society for technical talents. By analyzing the development process and the characteristics of skilled talents, and discussing the effective educational paths and strategies, we aim to improve the effect and quality of cultivating high-level technical talents in vocational undergraduate colleges.

2. Analysis of the current situation of cultivating high-level technical talents in vocational undergraduate colleges

2.1. Development course of vocational undergraduate colleges

As a crucial component of China's educational framework, the evolution of vocational undergraduate colleges

mirrors not only the adaptation and implementation of national educational policies but also directly correlates with socioeconomic development and industrial structure optimization. In the early 1980s, the Chinese government initiated efforts to advance vocational education, encouraging universities to pioneer innovative training models for technical personnel to meet the demands of rapid economic and social advancements at the time ^[1]. With the deepening of economic reforms and the establishment of a market-driven economy, vocational undergraduate colleges encountered unprecedented opportunities for growth. From the late 1990s into the early 21st century, the government formulated strategic initiatives to vigorously expand vocational education, bolstered policy support for vocational undergraduate institutions, and facilitated their rapid proliferation and development.

In recent years, amidst escalating societal demand for highly skilled professionals, vocational undergraduate colleges have intensified efforts in self-improvement and adaptation to cultivate proficient technical and skilled professionals. Particularly in refining professional disciplines and optimizing curriculum frameworks, colleges have evolved diverse and pragmatic educational structures tailored to the specific needs of various industries. Concurrently, these institutions have fostered deeper collaboration with enterprises, pioneering novel models that integrate industry, education, and research. This proactive approach has effectively aligned educational offerings with industrial requirements, significantly enhancing students' practical competencies and professional aptitude ^[2].

2.2. Connotation and characteristics of high-level technical and skilled talents

High-level technical and skilled talents play a crucial role in advancing modern society, characterized by their diverse and comprehensive skill set. These professionals are expected to possess robust technical knowledge, proficiency in advanced technologies and theories within their fields, and the capability to tackle intricate challenges effectively. Moreover, they are required to demonstrate innovation and practical skills, offering creative solutions, and adapting flexibly to evolving work demands. Collaboration skills are equally essential, enabling them to work seamlessly within teams and contribute to project success.

Additionally, these talents exhibit strong learning agility and adaptability, continuously acquiring new knowledge and technologies while maintaining personal growth ^[3]. Ethically, they adhere to professional standards and navigate complex ethical dilemmas with integrity. In cultivating high-level technical talents, vocational undergraduate colleges must holistically consider these attributes, enhancing students' overall competencies through curriculum optimization, robust practical education initiatives, and expanded partnerships with industry. These measures are essential to meet the increasingly dynamic needs of societal development.

2.3. Current situation of cultivating high-level technical talents in vocational undergraduate colleges

Vocational undergraduate colleges encounter both challenges and opportunities in cultivating high-level technical talents. As China's economic structure evolves, there is a growing demand for highly skilled professionals, presenting expansive market prospects for these colleges ^[4]. According to the Ministry of Education's National Report on Undergraduate Education Quality, as of 2020, vocational undergraduate colleges comprised approximately 20% of China's 1,265 regular undergraduate institutions, educating around 7 million students, constituting 40% of the total undergraduate population. However, these colleges face deficits in educational resources, faculty, and management effectiveness. Disparities in resource allocation limit curriculum development and experimental capabilities, thus impeding the quality of education ^[4]. Many institutions also struggle to recruit and develop high-caliber educators, hindering teaching standards and innovation.

Statistics reveal that the average value of teaching and research equipment in vocational undergraduate colleges is 5,000 yuan, below the national average of 7,000 yuan for regular undergraduate institutions. Similarly, these colleges possess an average of 50 books per student, lower than the national average of 70 books, underscoring deficiencies in academic resources. Elevating educational management is pivotal for overall institutional enhancement, particularly in curriculum reform, practical teaching, and industry collaboration.

Moreover, vocational colleges must address diverse industry demands for technical and skilled talent training modes. Different sectors necessitate tailored curricula to enhance program practicality and market relevance. Balancing these varied educational needs amidst broader societal and educational reforms is crucial. Strengthening internal governance and fostering external partnerships are essential strategies for improving educational quality and enhancing students' comprehensive capabilities. These efforts are vital for vocational colleges to effectively contribute to national economic advancement and social progress ^[5].

3. Exploration of the path of cultivating high-level technical and skilled talents in vocational undergraduate colleges

3.1. Optimizing the major setting and curriculum system

3.1.1. Adjusting professional settings based on industry requirements

Vocational undergraduate colleges must adapt to technological changes and industry talent needs by optimizing their professional programs. Emerging fields like information technology, artificial intelligence (AI), and biotechnology require colleges to establish majors such as AI engineering and bioinformatics to meet the growing demand for skilled professionals. Traditional sectors like manufacturing and construction also require new technical engineers and managers. Therefore, colleges should create programs in mechanical design, manufacturing, and construction engineering technology to enhance students' practical skills ^[6].

Professional optimization should also focus on interdisciplinary integration to develop well-rounded talents with innovative thinking. For instance, mechanical design students could study electronic engineering and computer science, while architectural engineering students could learn about environmental science and urban planning. This broader educational approach fosters comprehensive knowledge and innovative thinking. Aligning academic programs with industry demands enhances educational quality and academic influence, driving talent supply reforms ^[7]. This, in turn, injects new momentum into national economic development and social progress.

3.1.2. Constructing a modular curriculum system

With the progress of science and technology and the rapid change of market demand, the traditional integration of curriculum system makes it difficult to follow up with new technologies and ideas, and modular design allows colleges to quickly adjust and update each module, to ensure that the course content always follows the latest trends, thus providing students with the most practical and cutting-edge knowledge and skills. A modular curriculum system is beneficial to cultivating students' comprehensive and interdisciplinary abilities, through interdisciplinary module selection and combination, students can not only study the core knowledge of a professional field but also obtain a wide range of knowledge in different disciplines, backgrounds, and skills, enhance the ability of problem-solving and innovative thinking ^[8]. At the same time, the modular curriculum system also promotes the effective allocation and utilization of teaching resources. According to the actual situation of teaching resources and the needs of students, colleges and universities can reasonably allocate the teaching content and teaching methods of each module, so as to improve the teaching efficiency and quality.

When choosing modules, students can customize them according to their own interests and career planning, so as to improve their enthusiasm and initiative in learning and develop good learning habits and self-management ability.

3.2. Deepening school-enterprise cooperation and the combination of industry, university, and research

3.2.1. Strengthening school-enterprise cooperation and improving students' practical skills

By cooperating with enterprises to carry out practical teaching, practice, and other activities, students can directly participate in solving problems in practical work, get familiar with industry operation norms and procedures, and improve their practical operation skills and ability to deal with complex situations. Due to the rapid development of science and technology, enterprises often walk in the forefront of technology. Through cooperation with enterprises, colleges and universities can timely understand the latest developments and technical needs of the industry, so as to adjust and optimize the curriculum, ensure that the teaching content closely aligns with the market demand, and cultivate more competitive technical talents ^[9]. At the same time, through sharing resources, information, and technologies, the university and enterprises can jointly explore new technologies, processes, and products, and improve the efficiency of research and development. The scientific research achievements of colleges and universities can provide technical support for enterprises, help them solve practical problems, and improve product quality and competitiveness. Enterprises can provide a practical platform for colleges and universities so that scientific research achievements can better serve industrial development.

3.2.2. Promoting the integration of industry, university, and research institutes and promoting technological innovation

The integration of industry, university, and research realizes the deep integration of education, scientific research, and industry by integrating the resources and advantages of universities, enterprises, and scientific research institutions. By cooperating with enterprises and scientific research institutions to carry out joint research projects, universities can explore practical problems and needs, strengthen the combination of theory and practice, promote the transformation and application of scientific research results, and effectively enhance the ability and influence of technological innovation. When students participate in the industry-university-research integration project, they can not only have access to the latest scientific and technological achievements and the forefront of the industry but also cultivate critical thinking, innovative thinking, and teamwork through the process of practical operation and problem-solving, so as to lay a solid foundation for their future technology leader.

The integration of industry, university, and research can also promote the upgrading and development of the local economy and industry. Through close cooperation with local governments and enterprises, colleges and universities jointly study and solve key technologies and problems in the development of the local economy, promote the optimization and upgrading of the regional industrial structure, and enhance the overall competitiveness and sustainable development capacity of the local economy ^[10]. Through the active participation and promotion of universities in the integration of industry, university, and research, it can effectively integrate and optimize the national scientific and technological resources and innovation forces, and promote the healthy development of the national scientific and technological innovation system and the continuous improvement of scientific and technological strength, as shown in **Table 1**.

Table 1. Promoting the integration of industry, university, and research, and promoting technological innovation countermeasures

Measure	Concrete content	Expected effect
Promoting the integration of industry, university, and research institutes	Integrating the resources of universities, enterprises, and scientific research institutions to carry out joint research projects.	To realize the deep integration of education, scientific research, and industry, and enhance the ability and influence of technological innovation.
Promoting technological innovation	Universities should cooperate with enterprises and scientific research institutions to promote the transformation and application of scientific research achievements.	Students are exposed to the latest scientific and technological achievements and the frontiers of the industry to develop critical thinking, innovative thinking, and teamwork skills.
Participating in local economic and industrial upgrading and development	Universities cooperate with local governments and enterprises to study and solve key technologies and problems in local economic development.	We will promote the optimization and upgrading of local industrial structures, and enhance the overall competitiveness of local economies and their capacity for sustainable development.
Integrating and optimizing scientific and technological resources	Colleges and universities actively participate in and promote the integration of scientific and technological resources and innovation forces nationwide.	We will promote the healthy development of the national science and technology innovation system and enhance our scientific and technological strength.

3.3. Improving the level of teachers and teaching quality

Vocational undergraduate colleges should introduce professionals or researchers in the industry through continuous teacher training and academic exchanges, and constantly update teachers' professional knowledge and teaching skills. This not only helps teachers to have a deeper understanding of the latest developments in the industry but also improves their practical skills to interact with students in class and stimulate students' learning interest and innovative thinking. Vocational undergraduate colleges should also actively explore innovative teaching methods, such as problem-oriented learning and project-driven learning, so as to guide students to actively explore and solve practical problems and cultivate their critical thinking and practical skills. Colleges and universities should also pay attention to the diversity and flexibility of curriculum design, make personalized settings according to the needs of different majors and students, and improve the teaching and learning effects. At the same time, a scientific and reasonable teaching evaluation and feedback mechanism should be established to regularly evaluate teachers' teaching process and teaching effect, so as to find and solve the existing problems in time and ensure the stability and continuous improvement of teaching quality.

3.4. Expanding international cooperation and exchanges

Introducing advanced foreign educational ideas, methods, and resources enriches education content, broadens students' perspectives, and stimulates their interest in learning and innovation. Collaborating with top international universities through joint research projects enhances teaching and research standards. These projects unite global research expertise to address international challenges. Sharing teaching resources improves educational effectiveness, while double-degree programs offer expanded development and employment prospects, cultivating globally competitive talents. Hosting international scholars and participating in academic exchanges disseminates academic achievements globally, fostering deeper academic cooperation. Engaging in international academic competitions, exchange programs, and internships develops cross-cultural communication, teamwork, problem-solving, and innovation skills. These experiences enhance students' resumes and academic backgrounds, laying a robust foundation for future careers and global talent development.

4. Safeguard measures for cultivating high-level technical talents in vocational undergraduate colleges

4.1. Improving policy support and funding input

The government's role in shaping education policies for vocational undergraduate colleges is pivotal. It must provide targeted directives and allocate resources effectively to support talent development, teaching reforms, and faculty enhancement. Increased investment is crucial for upgrading infrastructure like laboratories, equipment, and libraries, especially in technology-related fields. This ensures students have access to state-of-the-art technologies and industry standards.

Moreover, competitive salaries and robust welfare packages are essential to attract and retain talented educators. Equitable distribution of educational funds fosters a supportive environment that encourages teacher creativity and enthusiasm. Enhancing teacher training programs and promoting academic exchanges is critical for continuous professional development and raising teaching standards. Government departments should tailor policies to meet the diverse needs of colleges and regions. Differentiated policies should incentivize innovation in high-quality vocational colleges, optimizing resource allocation. Rigorous monitoring and evaluation ensure funds are used efficiently, enhancing educational quality and meeting student needs effectively.

4.2. Establishing and improving the quality assurance and evaluation system

Establishing a robust quality assurance system is pivotal for enhancing overall educational quality and management within colleges and universities. Standardizing curriculum development, teaching content, and evaluation criteria ensures alignment with industry needs, thereby ensuring the practical relevance of students' knowledge and skills. A multi-dimensional evaluation framework encompassing academic performance, practical training outcomes, graduate employment rates, and other metrics provides a comprehensive assessment of educational effectiveness and students' comprehensive development. This system also emphasizes evaluating teachers' instructional competence and research contributions, encouraging them to innovate in teaching methodologies and advance in academic stature.

Continuous enhancement and dynamic adjustment of the quality assurance and evaluation system are essential. Institutions should periodically self-assess and adapt their evaluation frameworks to align with evolving educational trends and market demands. This proactive approach ensures that curricula are optimized, teaching methods are refined, and evaluation systems remain contemporary, effectively supporting the achievement of educational objectives. A well-established quality assurance and evaluation system not only elevates educational standards and academic standing but also enhances public trust and recognition of vocational undergraduate education. Transparent dissemination of evaluation results and data fosters collaboration between institutions and society, facilitating mutual support for sustainable advancements in vocational education.

4.3. Strengthening students' professional quality and innovation and entrepreneurship education

Enhancing professionalism through courses like career planning, communication, teamwork, and ethics helps students develop strong professional ethics and adaptability. These skills are crucial for their career development, fostering teamwork, leadership, and problem-solving skills. Innovation and entrepreneurship education plays a pivotal role in nurturing students' innovative and entrepreneurial spirit. Colleges should establish practical courses, mentorship programs, and project incubation platforms. These initiatives provide hands-on experience and guidance, stimulating students' entrepreneurial potential and fostering innovation. Such education not only enhances students' skills but also contributes to technological advancements and economic growth.

Colleges and universities should facilitate practical learning through partnerships with enterprises, industrial placements, and project-based training. This approach enhances students' problem-solving and innovation skills. Establishing a robust evaluation system is crucial to assess students' professional qualities, innovation, and entrepreneurship regularly. This enables timely identification of issues, adjustment of teaching methods, and continuous improvement of education quality. Strengthening these aspects not only enhances students' personal development and competitiveness but also fosters high-level technical talent with innovative spirit and practical skills, contributing to national development goals such as economic transformation and sustainable development. These efforts by vocational undergraduate colleges are pivotal for achieving talent development goals and meeting societal needs.

5. Conclusion

Vocational undergraduate colleges require various measures to cultivate high-level technical talent effectively. Policy support and increased funding are essential for ensuring education quality and facilities. A robust quality assurance system will monitor and enhance teaching standards. Emphasizing professional skills, innovation, and entrepreneurship cultivates students' overall competitiveness. International cooperation and exchange introduce advanced educational concepts and resources, aligning institutions with global standards and boosting their educational impact. These steps collectively elevate vocational colleges' ability to produce skilled, innovative professionals, meeting national development demands effectively.

Disclosure statement

The authors declare no conflict of interest.

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