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From college to university: A practical exploration of tertiary vocational education at Shenzhen Polytechnic University

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ABSTRACT

The emerging phenomenon of tertiary vocational education is a category of education positioned within vocational education. In China, tertiary vocational education has passed through the stages of "associate degree level" and "permitted establishment". Shenzhen Polytechnic University (SZPU), serving as an exemplary model of tertiary vocational education, plays a pivotal role in providing valuable insights for the transformation and development of other vocational institutions in China. This research aims to collect policy documents from SZPU and, through interviews from multiple stakeholder perspectives, gain an understanding of the perceptions and experiences of those involved in tertiary vocational education. It conducts an in-depth analysis of SZPU's motivations, trajectory, challenges, impacts, and countermeasures in initiating undergraduate vocational programs. On this basis, the study compares the educational practices of other institutions offering tertiary vocational education, synthesizes the pedagogical rationale and developmental directions of this type of education at a theoretical level, and proposes empirical and feasible developmental strategies at a practical level.

Key words: Shenzhen Polytechnic University, tertiary vocational education, practical exploration

INTRODUCTION

In recent years, the Party Central Committee and the State Council have attached great importance to vocational education. To improve the level of higher vocational education, develop undergraduate-level vocational education, and improve the framework system of modern vocational education, the newly revised *Vocational Education Law of the People's Republic of China* of May 2022 stipulates that: some majors set up by higher vocational schools at the junior college level to train high-end technical and skilled personnel must meet the conditions of deep integration of production and education, distinctive operational and administrative characteristics, and high training quality. Tertiary vocational education may be implemented after the examination and approval of the administrative department of education under The State Council.[1]

As a result, an increasing number of vocational colleges put their development goals on the positioning of tertiary vocational education. However, both theoretical and practical understandings of the concept of "tertiary vocational education" remain vague. Failure to clarify certain basic issues will inevitably lead to unclear positioning and haphazard reforms. As a model representative of tertiary vocational education, Shenzhen Polytechnic University (SZPU) has important empirical significance for the development and transformation of other vocational colleges in China.

This research collects and analyzes policy documents from SZPU, including the annual development plan, undergraduate teaching quality report, talent training

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report, and other papers related to college development and the reform of education and teaching. The paper combines these data with information gathered from interviews with various subjects to understand their personal views, experiences, perceptions, *etc.* and carries out an in-depth analysis of the motivation, process, challenges, impacts, and countermeasures within SZPU's establishment of tertiary vocational education. On this basis, the latest development plans, undergraduate teaching quality reports, and other documents reflecting tertiary vocational education were collected from the current 32 vocational undergraduate colleges and universities to analyze their development processes and orientations, the logic behind their upgrading or transformation, their improvement strategies, *etc.* The results of this analysis are used to compare these institutions with the tertiary vocational education offered by SZPU, summarize the logic and development guidelines of tertiary vocational education at the theoretical level, and put forward empirical and feasible development strategies at the practical level.

LITERATURE REVIEW: CURRENT SITUATION AND DEVELOPMENT OF TERTIARY VOCATIONAL EDUCATION IN CHINA

The development of tertiary vocational education

The new phenomenon of tertiary vocational education is a kind of education offered at a certain stage of vocational education. Typically, the provision of vocational education in China is government-led, and the government has introduced a series of policies to direct vocational education reform. The development of tertiary vocational education in China in terms of policy direction has undergone several stages.

The first stage was the "specialist level" of tertiary vocational education. In the 1980s, higher vocational education has gradually gained importance. After a long period of practice and exploration, it was gradually made clear in the policy that higher vocational education was a part of the specialized level of the higher education system. The *Higher Education Law of the People's Republic of China* promulgated in 1998 clarified that higher vocational schools are institutions of higher learning and that higher vocational education is an integral part of the higher education system.[2,3] In 1999, the Central Committee of the Communist Party of China and the State Council issued the *Decision on Deepening Educational Reform and Comprehensively Promoting Quality Education*, which stipulated that graduates of vocational and technical colleges who met the requirements of the selection examination could enter undergraduate institutions for further study.[4]

During the 1990s, under the guidance of the national strategy of expanding enrollment in higher education, the number and size of institutions offering higher vocational education increased rapidly. To further advance the quality of higher vocational education, *Several Opinions on Further Strengthening Vocational Education Work* were promulgated by the Ministry of Education and a further seven departments in August 2004,[5] and the *Decision on Vigorously Developing Vocational Education* was promulgated by the State Council in October 2005.[6] Both emphasized that vocational colleges at the junior college level would no longer be upgraded to undergraduate colleges. The rationale given was that "because most of the secondary vocational colleges at the junior college level were originally secondary vocational schools, their foundation and conditions are relatively weak. Thus, if the number of secondary vocational schools upgrading to tertiary vocational universities continues to rise, there will be a serious imbalance in the structure of higher education".[7] On the other hand, it was noted that "even after some higher vocational colleges were upgraded tertiary vocational universities, they continued to be run like local comprehensive colleges. In practice, the characteristics of vocational education have greatly faded, and they have not truly transformed into applied undergraduate colleges".[8]

Higher vocational education is limited to the junior college level, and various policy documents strictly require that vocational colleges at this level cannot upgrade to undergraduate colleges. However, some scholars believe that tertiary vocational education should not be regarded as a level of education but, rather, as a type of education and propose to further explore how higher vocational subjects can be taught at the undergraduate level.[9,10] Responding to calls from scholars and developments in related theory, in 2006, the Ministry of Education's *Several Opinions on Comprehensively Improving the Teaching Quality of Higher Vocational Education* clarified for the first time that "higher vocational education is a type in the development of higher education".[11] This was the first time that vocational education had been named as a type of education in a national normative document, which allowed the possibility of developing tertiary vocational education.

The second stage was tertiary vocational education as an "allowed establishment". First, ordinary undergraduate colleges, independent colleges, and newly built undergraduate colleges were transformed into applied technology-type colleges. In 2014, the State Council's *Decision on Accelerating the Development of Modern Vocational Education* proposed to guide a group of traditional ordinary undergraduate schools to become applied

technology colleges and universities focusing on undergraduate vocational education.[12] This was also the first time that a national policy mentioned "developing vocational education at the undergraduate level".[13] In March 2015, the Central Committee of the Communist Party of China and the State Council issued *Several Opinions of Deepening the Reform of System and Mechanism to Speed up the Implementation of Innovation Driven Development Strategy*, and in October, the Ministry of Education issued the *Higher Vocational Education Innovation and Development Action Plan (2015-2018)* and the *Guiding Opinions on Guiding the Transformation of Some Local Ordinary Undergraduate Colleges and Universities to Application-oriented Colleges and Universities* to accelerate the transformation of ordinary undergraduate colleges and universities into application-oriented colleges and universities. Subsequently, a large number of vocational and technical universities was established.

However, the transformation from ordinary undergraduate colleges, independent colleges, and newly built undergraduate colleges to applied technology schools was not widely recognized for the following reasons.

Under the guidance of the higher education resource allocation mechanism, the newly upgraded undergraduate colleges have basically "stayed away from vocational education" and turned to academic higher education. In practice, the transformation and development of ordinary colleges and universities in some places have stagnated, while the appeal for promoting vocational colleges at the junior college level has constantly rising, forming a stark contrast of "one cold, one hot".[7] On the other hand, in the process of merging higher vocational colleges with independent colleges and upgrading, amidst aroused public sentiment arising from the conversion in some provinces has made it more difficult to achieve the conversion through this path.[14]

Secondly, higher vocational colleges and ordinary undergraduate colleges demonstrated that they could jointly train undergraduates. In 2014, the Ministry of Education and a further six departments jointly issued the *Modern Vocational Education System Construction Plan (2014-2020)* encouraging junior college vocational colleges to explore how they could cooperate with undergraduate schools to "upgrade majors".[15] In response, some provinces took the lead in supporting vocational colleges at the junior college level and ordinary undergraduate schools to carry out the "3 + 2" (three years' study of a specialized subject at a vocational college + two years at an ordinary undergraduate school) segment training and "4 + 0" joint training (four years' study of a specialized subject at a vocational college). Without changing their education management system, ordinary undergraduate schools were responsible for managing enrollments, student status, and diplomas, and vocational colleges at the junior college level were responsible for managing teaching, students, and logistics. Some scholars believe that the "3 + 2" segmented training project and the "4 + 0" joint training project are essentially the initial prototype and beneficial exploration of tertiary vocational education. However, vocational colleges at the junior college level do not have the qualification to grant bachelor's degree certificates, and it is difficult to realize the training and promotion of tertiary vocational education within the vocational education system, and the quality of talent training is difficult to control.[7]

Thirdly, higher vocational schools at the junior college level carried out pilot undergraduate vocational education programs. In January 2019, The State Council issued the *Notice on Printing and Distributing the Implementation Plan of the National Vocational Education Reform*.[16] This plan replaced the provision that higher vocational colleges should not be upgraded or merged with one for "pilot vocational education at the undergraduate level". It also launched the construction plan for building high-level higher vocational schools and majors with Chinese characteristics (referred to as the "Double High Plan"). Subsequently, 197 higher vocational schools participated in the "Double High Plan". High-level vocational colleges have gradually become the predominant providers of tertiary vocational education, rather than higher education institutions.

The main body of tertiary vocational education began to shift away from ordinary undergraduate colleges and universities, exlporing application-oriented transformation, and toward high-level vocational colleges that actively pursued this transformation. Some scholars believe that "this is a sign of the formal establishment of the tertiary vocational education policy in China".[17] In May 2023, the Ministry of Education issued the *Announcement on Proposed Approval to Set up Undergraduate Colleges and Universities*, which agreed to integrate the resources of the Shenzhen Polytechnic to establish SZPU. The change of SZPU's identity marked a milestone, enabling it to independently manage tertiary vocational education.

Existing exploration of tertiary vocational education in SZPU

Focusing on the theoretical concept of "new tertiary vocational education", we summarized the unique practices of SZPU in terms of "vocational attributes", "undergraduate attributes" and "educational attributes". Firstly, in the aspect of "vocational attributes", SZPU's professional settings fully match Shenzhen's regional industries. According to an informant, to date SZPU has promoted 16 subjects to undergraduate majors,

including electronic information engineering technology, modern communication engineering, artificial intelligence engineering technology, intelligent manufacturing engineering technology, new energy vehicle engineering technology (physics category), and animation. These majors aim to meet the needs of future social and economic development as well as employment, and they closely follow Shenzhen's four pillar industries and emerging industry layout majors. These majors can be considered to form the SZPU "brand". Take electronic information engineering technology as an example; Shenzhen's electronic information industry accounts for nearly one sixth of the country's output value, which is a higher proportion than that of other first-tier cities.

It can be seen that SZPU has transferred its undergraduate majors through a process of fully matching Shenzhen's leading industries, pillar industries, strategic emerging industries, and advantageous industries, and the transfer closely aligns with the industrial development strategy of Shenzhen and even the entire Greater Bay Area. The industry is dynamically adjusted, emerging majors are constantly set up, and traditional majors are transformed. At the same time, the change is also the result of shifting employment demand. As one teacher said: "In terms of the construction of vocational undergraduate majors, the needs of the industry will be more prominent. At present, the school has more than 80 majors, and this will be adjusted to more than 50 majors after it reaches the undergraduate level".

Secondly, in terms of "undergraduate attributes", the design and delivery of education is highly aligned to the goal of talent cultivation. SZPU has always regarded talent cultivation as its central task, following the rule that it is running a vocational undergraduate school, and it aims to cultivate compound innovative high-quality technical and skilled talents adapted to the needs of the intelligent era. Details of this orientation are given below.

Adhering to "vocational attributes"

First, the semester schedule has been adjusted moderately, and the three-semester system has been piloted, making full use of the summer semesters to arrange internships and practical training for students. A teacher said: "After the upgrade to bachelor's degrees, the proportion of theoretical and practical courses accounting for 50% will not change, and the practical courses will not be compressed as in the case of general undergraduate courses, and the way [to do this] is to adopt the three-semester system". Second, the teaching content has been arranged to ensure the integration of vocational and general education and integration of theory and practice (including) the Vocational Specialist Program, the Four-Room Integration Program, the Targeted Curriculum Program, and the Practical Teaching Enhancement Program. Thirdly, SZPU has implemented the characteristic curriculum reform of "innovation and entrepreneurship" and builds "four meetings, two competitions and three alliances" entrepreneurship and innovation exchange platforms as well as "innovative clubs, creator centers and student creative entrepreneurship parks" on an entrepreneurship and innovation practice platform.[18] According to the needs of projects and products, the following tasks are necessary: to establish inter-college and inter-disciplinary Creator Classes and Creative Classes and customize talent cultivation programs and teaching teams; to develop high-level innovation and entrepreneurship courses; to encourage diverse forces to participate in innovation and entrepreneurship education; and to gradually improve the entrepreneurship and innovation service system for cross-border integration, product trial production, business incubation and venture investment.

Expand the "undergraduate attribute"

First, it is important to further raise the professional standards of talents. Taking the undergraduate program of "new energy automobile engineering technology" as an example, some teachers said: "The first vocational specialization was automobile maintenance and after-sales service, but now it has been extended to the front-end of production, research and development, and manufacturing". Some teachers also believe that "the concept of tertiary vocational education should adhere to the competency-based approach". A competency-based approach must emphasize students' independent choice of cross-border compound learning and focus on independent learning ability and comprehensive literacy training so that vocational undergraduate training of students is matched to vocational specialties, giving students the ability to develop their careers.

Second, the basic curriculum will be further emphasized. To adapt to the undergraduate level, there will be major adjustments in the systematic nature of the courses and their levels of difficulty. A major feature of the new cultivation program is that it ensures that students are equipped with a complete and standardized knowledge system and obtain strict professional basic training so that tertiary vocational education can also become a broad-bore professional education. For example, the undergraduate major in electronic information technology engineering has added two basic courses, "University Physics and Experimental Design" and "Engineering Applied Mathematics"; the undergraduate major in Artificial Intelligence Engineering Technology has added two basic courses, "Linear Algebra" and "Discrete Mathematics"; and the undergraduate major in New Energy Vehicle Engineering Technology has added two basic courses, "Engineering Mechanics" and "Linear

Algebra".

The third measure is to promote general education by implementing the *Implementation Outline of Cultural Education*, improving the "6 + 2 + 1 + 4" cultural education curriculum system in which compulsory courses and elective courses are parallel, and strengthening the cultural penetration of professional education. The fourth measure is to comprehensively promote the construction of the academy system, strengthen the guidance given to students about career development, implement the student annual development report system, and explore the guidance for students' whole-person development.

New exploration of an "undergraduate education college"

To explore the "new type of tertiary vocational education", as stated by the senior officials at universities, SZPU has abandoned the traditional vocational specialization thinking, and established a tertiary vocational education from scratch, rather than simplifying adding one more year course to the original three-year program.

In terms of "educational attributes", SZPU closely integrates applied scientific research with the needs of industrial enterprises. Application-oriented scientific research is a typical "SZPU characteristic". The school continues to deepen the reform of the scientific research system and mechanism, adhere to the "industry-academia-research-use" integration of scientific research, and pay attention to technology transfer and the dissemination of scientific and technological achievements. This study found that research has the characteristics of "facing regional industries, closely relying on the industry, and uniting with leading enterprises". As a teacher discussed in the focus group discussion: "Whether higher vocational colleges and universities should engage in scientific research or not, should be engaged in, but unlike ordinary undergraduate colleges and universities, to establish the application-oriented route, the staggered development, 'to find a position in the technologization of science and the industrialization of technology'."

First, through strengthening cooperation with government departments (such as the Shenzhen Economic, Trade and Information Technology Commission) and industry associations (such as the Fashion Creative Alliance and Entrepreneurs' Alliance), three major comprehensive research and development (R & D) platforms have been set up, namely, the Institute of Applied Technology, the Institute of Cultural and Creative Products, and the Institute of Economic and Social Development. Second, SZPU works closely with Huawei, ARM, Alibaba, Ping An, BYD, Yu Tong, Tianjian and other first-class enterprises to build 15 characteristic industrial colleges, such as Huawei College of Information and Network Technology, ARM College of Intelligent Hardware, BYD College of Applied Technology, Yu Tong College of Digital Graphics, Tianjian College of Construction and Engineering, and so on.[19]

It is also stated to collaborate with a group of world-renowned enterprises to establish a number of applied technology research and development centers. The annual total amount of scientific research funding stands at 100 million yuan (approximate 14,046,500 USD), of which the proportion of applied technology R & D funding to total research funding is over 70%. The school's applied technology services benefit 10% of Shenzhen's backbone small, medium, and micro enterprises. The last measurement is to form applied technology research and development teams. Led by academic leaders and technical masters, 10 influential applied R & D teams will be formed.

PRACTICES OF THE 32 VOCATIONAL AND TECHNICAL UNIVERSITIES

Higher tertiary vocational education is the product of the rapid development of China's economy and society and the continuous adjustment and improvement of the modern vocational education system. With the rapid development of China's economy and society, the systems and types of programs offered by Chinese higher education have been subject to continuous improvement and reform. The continuous adjustment and deepening of the national economic industrial structure and employment structure objectively require the improvement of higher education so that graduates can meet current industrial development requirements in terms of innovation and comprehensive abilities and employers' demand for high-level talents.

From the practical point of view, tertiary vocational education is a new phenomenon in China. On the one hand, its development concerns society in general; on the other hand, some scholars and higher education administrators have expressed deep concern about its quality. For example, scholars have pointed out that "the high-quality development of tertiary vocational education still faces many practical difficulties, including internal challenges such as unclear positioning, unreasonable professional settings, and insufficient teaching staff, as well as external challenges like lack of funding, lack of government support, and social recognition".[20] There is a need for in-depth reflection on the quality of vocational colleges after their upgrade to undergraduate status and for timely warnings about the educational

difficulties and pitfalls they may encounter.

Therefore, it is necessary to delve deeper into the concept of the quality of tertiary vocational education and then evaluate and enhance the educational quality of vocational undergraduate programs. Taking the 32 pilot vocational undergraduate schools in China as the object of investigation and comparison and their practical exploration as the research content, this study adopts a "macro-medium-micro" perspective to delve into and compare the positioning of the schools and their statutes, talent training programs, faculty team building, and funding (micro level) before and after their upgrade to undergraduate status. It explores the practical paths and current difficulties of tertiary vocational education.

Achievements of the 32 vocational technical universities in practice

There has been much discussion of the development orientation of tertiary vocational education. The misconception in developmental positioning is an important reason that tertiary vocational education has fallen into the "trap" of upgrading to undergraduate status. After being upgraded to vocational undergraduate institutions, vocational colleges continuously oscillate between vocational undergraduate, general undergraduate, applied undergraduate, and higher vocational colleges, with most schools moving toward an extreme.

In fact, vocational undergraduate colleges are significantly different from the other three types of institutions. Vocational undergraduates must meet the needs of industrial transformation and upgrading as well as economic and social development, and the talents cultivated should be oriented to high-end industries or the industrial high-end and have high-level technical skills and specialized technical skills.[21] Vocational undergraduates are not the same as general or applied undergraduates, and a vocational undergraduate college is not a higher vocational college. The similarities and differences between different types of education are shown in Table 1 below. The study found that most of the 32 colleges and universities in the sample have discussed development orientation.

Another aspect of this study is the reformulation of university charters. A university charter is the general guideline for university management, and an objective need for governing the school and running the school in accordance with the law. It plays an important foundational role in advancing the modernization of the school's governance system and governance capabilities. The 32 vocational and technical universities have reformulated their school charters to reflect the characteristics of how vocational undergraduate schools should be run and their talent cultivation requirements. As shown in Table 2, the research found that most of the 32 universities have reformulated their talent cultivation plans after upgrading to undergraduate status.

The third practice is to reformulate talent cultivation plans. In terms of vocational orientation, the design of the curriculum system meets the requirements of the reform of the vocational undergraduate level; reflects the new technologies, techniques, and specifications as well as the requirements of vocational positions (groups); embodies the organic combination of academic education and vocational ability development; and has measures to cultivate students' comprehensive, professional, innovative, and entrepreneurial abilities. In terms of practical orientation, the plan highlights the characteristics of practice orientation and an equal emphasis on theory and practice. The cultivation plan strengthens the cultivation of practical abilities, builds the practical teaching mode of "basic practice, professional practice, and comprehensive practice", scientifically sets up practical teaching links such as curriculum practice, meets the requirements of basic, process, and comprehensive practice, and raises the proportion of comprehensive and design experiments. In terms of basic orientation, basic knowledge learning and basic technical skills training are strengthened. The cultivation plan encourages students to participate in obtaining vocational skill-level certificates (X certificates or those issued by the Ministry of Human Resources and Social Security) and participate in high-quality technical skill competitions, *etc.* to gain comprehensive professional knowledge and technical skills.

Existing problems in the operational practices of 32 vocational and technical universities

The first problem is the dilution of the "vocational" of school orientation. Clearly defining one's own educational positioning and clarifying one's own educational characteristics are the primary issues for the high-quality development of tertiary vocational education. However, current vocational undergraduate institutions are in an awkward situation of being caught between vocational specialized education and general undergraduate education.

On the one hand, there is a path dependency in vocational specialized education, with a lag in the transformation of thought and educational practice. On the other hand, vocational specialized education is greatly influenced by general undergraduate education and is suspected of falling into the trap of "academic drift". Due to the relatively short history of vocational undergraduate institutions in China, it can be said that such institutions are still in the initial stage. Thus: lacking mature models for reference and eager to overcome the

Table 1: Characteristics and requirements of different types of education

Characteristics and requirements	Vocational undergraduate	General undergraduate	Applied undergraduate	Higher vocational college
Specificities	Vocational orientation, complexity of technical skills training, integration of teaching and production	Non-utility, interdisciplinarity, sustainability of development	Practical in purpose, technical in content, professional in organization	Career-oriented, content emphasizes skills
Educational requirements	Emphasis on advanced vocational competence training, on-site practical teaching, and the development of vocational qualities	Emphasis on basic theoretical education, training in scientific research methods, and cultivation of a sense of innovation	Emphasis on technical training, the cultivation of problem-solving abilities, and the development of engineering awareness and professional ethics	Emphasis on the development of low-level vocational skills rather than professionalism and problem-solving abilities

Table 2: Excerpts from the charters of the sample tertiary vocational universities

College	Key points of school positioning
A	Facing *** industry; integrating and supporting the development of new business; cultivating high-level technical and skilled talents. Building the university into an undergraduate-level vocational education institution of higher learning with a focus on*** and the coordinated development of *** and other multidisciplinary disciplines
B	Adhering to the principle of education centered on cultivating people; a focus on serving local economic and social development, accurately connecting with industrial transformation and market demand, and building a well-known and distinctive undergraduate-level vocational university in China
C	Focusing on high-end equipment manufacturing, modern logistics, and other manufacturing industries and modern service industries to coordinate the development of the discipline and professional systems; building an undergraduate vocational college with distinctive features and outstanding advantages, with high repute in the province and country
D	School attributes: High-level vocational education category Cultivation objective: To cultivate high-level technical and skilled talents with the all-round development of morality, intelligence, physicality, and aesthetics, a sense of social responsibility, and a sound personality; to impart the necessary theoretical foundation of the profession and mastery of the core skills of the profession; to imbue the spirit of professionalism, innovation, and craftsmanship and adapt to the needs of the new technological revolution and industrial upgrading
E	Creating undergraduate vocational schools that lead the reform of vocational education, support development, have distinctive characteristics, and are first-class in the region

inherent bias of society's undervaluation of vocational education, vocational undergraduate institutions have overly imitated general undergraduate education in terms of training objectives and models. They tend more towards knowledge education rather than high-level vocational skills training, failing to fully highlight the intrinsic attributes of vocational education. They have not sought characteristic development based on the type characteristics of vocational education, and the phenomenon of "academic" drift has begun to emerge.[20]

For example, a vocational and technical university in Guangdong always adhered to the positioning of "actively exploring the close integration of work and study, the fusion of schools and enterprises in nurturing talents, and being a cradle for cultivating future small and medium-sized enterprise owners" before it was approved as a pilot school for vocational education reform at the undergraduate level in 2019.[22] Thereafter, it revised its educational positioning to "be committed to cultivating high-level and high-quality technical and skilled talents who are oriented towards the front line of production and service, with a certain academic background, solid professional foundation, active innovative thinking, strong practical ability, and high comprehensive quality".[22]

It can be seen that on the one hand, the revised orientation of some vocational undergraduate colleges and universities has weakened their vocational education genes, leaving tertiary vocational education facing a crisis of legitimacy that concerns its very survival. On the other hand, the "undergraduate nature" is not sufficiently manifested. Due to the inertia of school operations and the limitations imposed by practical conditions, some vocational undergraduate colleges and universities continue the inherent operational and administrative practices of specialized schools. That is, they aim to cultivate first-line basic technical workers and do not pay sufficient attention to technological innovation and scientific research or to cultivating students' vocational ability and innovation literacy. Consequently, it is difficult to cultivate high-level technical talents with the ability to innovate.

The second problem is the lack of planning in program design. Program design is crucial in ensuring the high-quality development of higher education institutions, and tertiary vocational education is no exception. The programs offered by tertiary vocational institutions should align with their talent cultivation goals, reflect

their educational positioning and core values, and lay a solid foundation for producing high-quality, highly skilled professionals. However, in practice, many tertiary vocational institutions face challenges in their program design.

The lack of scientific validation and disregard for comprehensive planning in program design has hindered vocational education institutions from fully serving regional economic and social development. The root cause of this issue lies in the fact that China's tertiary vocational education system is still in its exploratory and developmental stages. Institutions lack theoretical guidance and experience in program design, leading to a "crossing the river by feeling the stones" approach. Besides historical factors, the conditions under which these institutions operate play a key role in shaping tertiary vocational education. Currently, tertiary vocational institutions in China are at a disadvantage in terms of both infrastructure and faculty resources. As a result, many institutions can only offer programs that are within the limits of their available resources.

An analysis of newly established programs in 32 vocational universities after their upgrade to undergraduate status revealed a significant convergence in program design. Among the many newly established programs, software engineering, international economics and trade, marketing, and public administration frequently appeared, becoming popular choices across institutions. Statistics show that over half of these vocational universities have established the above-mentioned programs. Evidently, the similarity in program offerings does not align with the principles of higher education development and is not conducive to the high-quality development of vocational universities.

The homogenization of program design presents several challenges for these institutions. First, the lack of distinctive and strong programs directly undermines the cluster effect of academic programs, leading to insufficient synergy between different disciplines. In reality, the economies of scale generated by program clusters are key to overcoming the initial instability in the development of vocational universities. Second, the randomness and homogeneity in program design make it difficult for vocational universities to interact and collaborate effectively with the economy and society, particularly in high-end and cutting-edge industries. This disconnect may also lead graduates to experience difficulties finding their niches in the job market, perpetuating and deepening societal misunderstandings and prejudices against vocational education.

The third problem is that faculty development urgently needs improvement. Faculty members are the key force behind the success of universities. Currently, tertiary vocational institutions in China face challenges related to insufficient faculty strength in terms of both size and structure. On the one hand, the faculty teams in these institutions are relatively small. The low societal recognition of tertiary vocational institutions makes them less attractive to talented faculty. Moreover, most faculty members in these institutions come from research universities, where they have been deeply ingrained in academic environments, developing academic habits that resist direct engagement with the market and industry. From a practical standpoint, choosing to work at a tertiary vocational institution may seem risky and unconventional for many faculty members, considering factors such as salary, resources, and career prospects. Consequently, despite recognizing the importance and necessity of optimizing their faculty teams, tertiary vocational institutions find it difficult to attract and retain sufficient high-caliber talent.

On the other hand, these institutions face structural challenges within their faculty teams. The faculty structure is not optimal, with relatively low proportions of "dual-qualified" faculty (*i.e.*, those with both academic and industry experience) and senior-level faculty. Overall, the quality of faculty teams remains inadequate. In recruiting new faculty, some tertiary vocational institutions place excessive emphasis on academic qualifications, often prioritizing advanced degrees over professional and technical expertise, although the latter are more important for vocational education. This has resulted in a mismatch between the disciplinary knowledge of some new hires and the institution's development needs, making it difficult for these faculty members to meet the demands of high-quality vocational education.

The fourth problem is insufficient educational funding. In recent years, although educational authorities have increased funding for vocational education, the additional funds have only covered the shortfall caused by policy-driven salary increases and rising operational costs. In reality, tertiary vocational institutions in China generally face challenges such as insufficient investment in professional equipment, outdated and inadequate training facilities, and a disconnect between teaching and practice, which limits students' hands-on skills development. The cost of vocational education continues to rise each year, and the actual needs of vocational education far exceed the increased funding, creating a paradox where funding is continually rising, but the demand for funds is ever more urgent. To cut costs, many tertiary vocational institutions focus heavily on establishing programs in the humanities, as these programs require fewer resources, such as facilities and equipment, and do not need extensive training centers or practical bases.

For example, at one vocational university in Guangdong Province, the total revenues in the years from 2015 to 2017 (*i.e.*, before it obtained undergraduate status) were 218.7589 million yuan, 202.2935 million yuan, and 269.3703 million yuan, respectively. The per-student funding was 19,900 yuan, 16,900 yuan, and 28,100 yuan, respectively. After upgrading to undergraduate status, the total funding for 2021 was 494.2149 million yuan. However, compared to the nearly 3.3 billion yuan in funding for Shenzhen Polytechnic, the funding shortfall at most vocational universities is glaringly evident.

COUNTERMEASURES AND RECOMMENDATIONS: THE FUTURE DEVELOPMENT OF TERTIARY VOCATIONAL EDUCATION

Theoretical exploration: the development positioning of tertiary vocational education

First, vocational characteristics should be enhanced; that is, tertiary vocational education should not be run as general undergraduate education. Higher vocational education is a type of higher education, not a level. The *International Standard Classification of Education* clearly states that vocational education at the undergraduate level is a type of education that belongs to the undergraduate level and runs parallel to general higher education. The "undergraduate" in the terms "vocational undergraduate" and "general undergraduate" has different connotations. Vocational undergraduate education has emerged as vocational education that has developed to a certain stage.[23] Some researchers point out that vocational undergraduate education is a shorthand for concepts such as vocational technical undergraduate education, vocational category undergraduate education, tertiary vocational education, and applied technical tertiary vocational education and is a subcategory of applied undergraduate education.

This kind of undergraduate education is generated by the needs of industrial transformation and upgrading and economic and social development, and the talents cultivated should be oriented to high-end industries or the industrial high end, with a focus on cultivating high-level technical skills and specialized technical skills talents. General undergraduate education, on the other hand, is academic education, focusing on basic theoretical research, major projects, and the cultivation of academic and research-oriented talents.[21] Vocational undergraduate and general undergraduate education have typical differences in many dimensions, such as cultivation objectives and cultivation methods.[24] Therefore, vocational undergraduate education is future-oriented vocational education, serving industrial upgrading and technological revolution, with a particular emphasis on the content of new technologies, the application of new technologies, and the R & D of applied technology. Application and R & D are two important aspects of new technologies.[21] At the same time, only by upgrading vocational or technical characteristics can the talents cultivated by tertiary vocational education truly meet the increasingly high social demands.

Second, to strengthen the undergraduate nature of tertiary vocational education, the latter should not be an upgraded version of specialized education. The undergraduate nature of tertiary vocational education is a new element that the latter brings to vocational education. Many teachers mentioned in interviews the need to enhance the undergraduate nature of this type of education in school operations, indicating that tertiary vocational education is not an extended version of higher vocational specialized education. However, there is a view in society that tertiary vocational education is indeed an extension of specialized vocational education, which clearly confuses vocational undergraduate and specialized education. The foundation for establishing vocational undergraduate schools is mostly based on the upgrade of higher vocational specialties or school mergers. At the societal level, some, including some teachers of higher vocational specialties, believe that the talent training program for vocational undergraduates should become a three-year specialized program. They even believe that the training methods, objectives, and approaches can fully refer to the model of higher vocational specialties by adding courses and increasing class hours to make up for a year.

From a practical point of view, vocational education at the undergraduate level can better solve real problems. Among the talent training goals of tertiary vocational education are to meet the various professional technical requirements and abilities of occupations and cultivate students' abilities to comprehensively apply various professional technologies to solve complex professional problems. Training such talents requires tertiary vocational education to combine disciplinary professional theoretical education, general education, and technical skill training education, which is an important way for tertiary vocational education to achieve career orientation.[23] In addition, the stronger educational function of undergraduate-type learning can well respond to the needs of modern society. Tertiary vocational education should pay attention to "careers", "professionals", and, in particular, "people".[23] Therefore, it is essential to strengthen students' lifelong learning ability and the cultivation of applied innovative thinking abilities. As the saying goes: give a man a fish and you feed him for a day, teach a man to fish and you feed him for a lifetime. The economy, industrial structure, and job requirements are constantly adjusting. Only if graduates are equipped with the ability to

continuously learn in their professional positions can they maintain their competitiveness.

Third, to balance vocational-type and undergraduate-type learning characteristics, tertiary vocational education should not become a case of "two separate skins". The core of the relationship between tertiary vocational education, general undergraduate education, and higher vocational specialized education lies in the relationship between the vocational and undergraduate nature of education. Tertiary vocational education needs to balance the vocational and undergraduate nature of its courses, and the biggest problem it currently faces is the loss of this balance. The basic structure of tertiary vocational education is the close integration of knowledge, skills, and quality. Taking courses as an example, offering courses that are both vocational and undergraduate in nature will not prevent the "two separate skins" situation. Only when these two types of learning are deeply integrated can the purpose of tertiary vocational education be truly realized. High-level technical and skilled talents are those who, through professional study in school, have technical application ability in a certain industry field, which includes not only operational skills but also comprehensive service abilities such as problem analysis, problem-solving, technical consultation, and technical training. It is clear that such talents have not only the various skills cultivated by vocational-type education but also the comprehensive qualities cultivated by undergraduate-type education. Only tertiary vocational education that deeply integrates vocational- and undergraduate-type education can truly cultivate senior skilled talents with composite abilities.

Optimizing the path: the future development of tertiary vocational education at SZPU

In terms of development orientation, it is necessary to reposition tertiary vocational education. Vocational undergraduate education at SZPU should not only be positioned differently from ordinary undergraduate education but also from other vocational undergraduate "flagship vocational and technical universities", as phrased by a senior officer at the university. At a higher level than specialties, SZPU can keep the advantages of higher vocational specialties, quickly inject undergraduate attributes, act as a model of vocational undergraduate schooling, and move from "imitative creation" to "autonomous creation" to determine its special characteristics. In terms of educational model, vocational undergraduate education is "newer" than traditional undergraduate programs; on the one hand, it integrates academic- and vocational-type education, deepening vocational teaching through academic innovation; on the other, it uses the vocational side to support the academic side, opening up a "vocation-education-research" transformation channel and creating a new academic ecosystem for a new type of tertiary vocational education. In terms of social service, the university is "integrated" with industry, upgrading its levels and vocational characteristics, strengthening undergraduate attributes, and orienting education toward future industrial upgrading and change.

In terms of cultural construction, it is necessary to foster a campus culture of compliance with the spirit of craftsmanship. The cultural construction of SZPU is distinct from that of ordinary higher education institutions. It is based on the goal of cultivating "high-quality technical and skilled talents with compound innovation" and elevates the construction of a university culture with vocational education characteristics to the core of the school's educational philosophy. This culture should not only be different from the school culture of general higher education but also reflect the characteristics of tertiary vocational education in talent cultivation. Therefore, it is necessary to inherit and renew the basic material culture, lead development with concepts and goals in spirit, improve standards and norms in the system, and focus on the teaching and management of behavior. This approach will enable SZPU to ground itself in vocational characteristics and cultivate a campus style that follows the spirit of craftsmanship.

In terms of scientific research and construction, it is necessary to aim at high-end applications and help innovative R & D. Currently, the research and application achievements of SZPU are limited by the constraints of the specialized training level, which focuses more on basic industrial links. After the upgrade to an undergraduate institution and the improvement of the platform and teaching, it is necessary to further aim at high-end applications for continuous R & D based on existing school-enterprise cooperation, moving from mid- to high-end and from basic technical skills to high-precision and high-end technical skills. Relying on multiple cooperation partners, a distinctive research paradigm should be created that integrates industry and education, such as the "teaching-enterprise" research model oriented toward the entire teaching process, the "course-enterprise" research model in stages, and the point-to-point "teacher/student-enterprise" research model, to explore effective paths for the seamless integration of teaching and production. At the same time, it is necessary to build a high-level technical and skill innovation service platform, strengthen international cooperation, and enhance the international level of training of high-level technical and skilled talents.

In terms of teaching reform, it is necessary to integrate theory and practice and break down inherent boundaries. The teaching reform of tertiary vocational education is neither the transformation of traditional undergraduate education nor the improvement of traditional higher vocational specialties. Rather, it concerns getting rid of the traditional inertia in thinking,

organically unifying people and careers, and comprehensive design and reform. Firstly, the reform plan highlights the organic integration of general education and professional education, comprehensively improves students' comprehensive vocational quality and action ability in general education,[25] and focuses on cultivating students diversified professional and technical skills in professional education. Secondly, the development of project-based teaching will shorten the distance between the supply and demand of talent in schools and enterprises. Thirdly, connecting the fixed classroom and the fixed semester, realizing an orderly connection between the "small classroom" of the school and the "big classroom" of society, making good use of the advantages of the "third semester system", and scientifically planning the semester tasks.

In terms of the construction of the teaching team, it is necessary to encourage diversified cooperation and facilitate joint achievement. The most important task for tertiary vocational education is to build a sufficient "dual qualification" teaching team with high levels of theoretical knowledge and strong hands-on abilities. It is necessary to adhere to the combination of "introducing, educating, utilizing, and retaining", innovate the mechanism of teaching staff construction, and strive to improve the quality of teachers' "multi-competence".[26] Second, to empower teachers to improve their skills, teachers should stand at the forefront of industry and technology, constantly absorbing the cutting-edge technology of relevant industries and constantly enriching their own skills. Third, teachers should be encouraged to engage in broad cooperation, carrying out teaching and research activities driven by tasks, meeting the needs of jobs, and undertaking team-based teaching arrangements and curriculum design. Finally, we should promote the incubation of the results of co-creation between teachers and students to form a whole chain innovation and entrepreneurship system of "dual-creation cultivation, practical training and practice, project incubation, and results transformation" to accelerate the transfer and dissemination of the scientific research results of teachers and students.

Finally, it is necessary to optimize the scientific evaluation system and digital quality assurance. The means used to effectively assess vocational undergraduate institutions is an important reflection on the fairness and scientific nature of tertiary vocational education. The first aim is to improve the internal assessment mechanism of vocational undergraduate institutions, diagnose the internal quality of institutions from point to point, design special audit standards applicable to vocational undergraduate institutions, carry out cyclical assessments, and construct a quality evaluation mechanism for tertiary vocational education based on the principle of "multiple subjects + collaborative governance". Second, the quality assurance system of digital education should be improved. In the quality assurance system of "full participation", based on the development foundation and characteristics of the school, the multifactorial internal quality assurance structure should be improved, the digital transformation of collaborative governance should be realized, data-sharing and resource integration should be undertaken, and an intelligent governance pattern of scientific decision-making, smooth implementation, and powerful supervision should be constructed.

CONCLUSION

In summary, tertiary vocational education refers to an educational model at the undergraduate level that combines vocational and technical training with academic education. It aims to cultivate high-quality, skilled professionals with practical abilities and specialized knowledge. Compared to traditional general undergraduate education, tertiary vocational education places greater emphasis on the development of practical skills and is closely aligned with industry needs. In terms of curriculum design, it emphasizes the organic integration of theoretical knowledge and practical application, typically covering foundational courses, vocational skills training, and internships or projects in real work environments.

As the demand for skilled professionals in society continues to grow, tertiary vocational education not only promotes the transition of higher education from "mass education" to "universal education", thereby expanding its reach, but is also gradually becoming a crucial force in driving economic transformation and upgrading as well as promoting social development. Overall, the practice of tertiary vocational education is an educational response to the high degree of specialization in functions and roles within society. It is not only embedded within various external social organizations but also depends on the interaction between different internal elements within educational institutions, requiring the focused attention of stakeholders such as the government, schools, and enterprises.[27]

Therefore, as an increasingly advanced form of higher education within the global vocational education system, China's tertiary vocational education is currently at a critical stage of development. It is essential to "clarify the underlying logic of aligning educational supply with industry demand and elucidate the mapping relationship between industry needs and educational supply to ensure that demand and supply structures are mutually aligned".[28] Additionally, there must be enhanced policy support and institutional guarantees to provide normative guidelines for the development of tertiary vocational education, including the establishment of tertiary vocational institutions. Moreover, it is crucial to deepen the integration of industry and education, as well

as school-enterprise cooperation, to meet the needs of emerging industries and technological advancements, drive curriculum reform and teaching innovation, and improve the alignment between vocational qualifications and degree education, thereby offering students more opportunities for skills certification.

DECLARATIONS

Author contributions

Zhang YH: Conceptualization, Data curation, Writing—Original draft, Investigation. Xiao Y, Zhang R, Tan ZY, Zhu XL, Qu XX: Conceptualization, Investigation, Writing—Original draft. Yu JR: Supervision, Project administration, Investigation, Conceptualization, Writing—Review and Editing. All authors have read and approved the final version of the manuscript.

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REFERENCES

1. [Vocational Education Law of the People's Republic of China]. Ministry of Education of the People's Republic of China. Updated April 20, 2022. Accessed January 15, 2024. http://www.moe.gov.cn/jyb_sjzl/sjzl_zcfg/zcfg_jyfl/202204/t20220421_620064.html
2. Chen BH. [Policy changes and development strategies of vocational undergraduate education]. *Explor High Educ.* 2022;(5):24-29.
3. [Higher Education Law of the People's Republic of China]. Ministry of Education of the People's Republic of China. Updated December 29, 2018. Accessed January 20, 2024. http://www.moe.gov.cn/jyb_sjzl/sjzl_zcfg/zcfg_jyfl/202204/t20220421_620257.html
4. The Central Committee of the Communist Party of China. [Decision on Deepening Education Reform and Comprehensively Promoting Quality Education]. Law library. Updated June 13, 1999. Accessed January 21, 2024. http://www.law-lib.com/law/law_view1.asp?id=69684
5. [Several Opinions on Further Strengthening Vocational Education Work]. Ministry of Education of the People's Republic of China. Updated September 14, 2004. Accessed January 22, 2024. http://www.moe.gov.cn/srcsite/A07/moe_737/s3876_qt/200409/t20040914_181883.html
6. [Decision on Vigorously Developing Vocational Education]. Ministry of Education of the People's Republic of China. Updated October 28, 2005. Accessed January 23, 2024. http://www.moe.gov.cn/jyb_xxgk/moe_1777/moe_1778/tnull_27730.html
7. Zhao HL, Gu DL, Wang YP. [Policy evolution, inner meaning and development strategy of tertiary vocational education]. *Vocat Educ Forum.* 2022;38(06):24-30.
8. Qu LG, Shao JD, Wei Q. [Toward integration: The development direction of China's tertiary vocational education policy]. *Vocat Tech Educ.* 2021;42(24):18-23.
9. Guo Y. [Research on the strategy of developing technical undergraduate courses in my country]. *Vocat Tech Educ.* 2002;(1):9-13.
10. Li J, Wei SM. [Misunderstandings and corrections in developing undergraduate higher vocational education]. *Fudan Educ Forum.* 2003;(6):41-43.
11. [Several Opinions on Comprehensively Improving the Teaching Quality of Higher Vocational Education]. Ministry of Education of the People's Republic of China. Updated November 16, 2006. Accessed January 24, 2024. http://www.moe.gov.cn/srcsite/A07/s7055/200611/t20061116_79649.html
12. [Decision on Accelerating the Development of Modern Vocational Education]. Ministry of Education of the People's Republic of China. Updated May 2, 2014. Accessed January 25, 2024. http://www.moe.gov.cn/jyb_xxgk/moe_1777/moe_1778/201406/t20140622_170691.html
13. Li S. [Research on the development path and methods of teaching standards for undergraduate vocational education]. *Vocat Educ.* 2024;23(05):30-34.
14. He W. Tertiary vocational education: The value of the times and strategic choices. *Educ Theory Pr.* 2021;41(33):21-24.
15. [Modern Vocational Education System Construction Plan (2014-2020)]. Ministry of Education of the People's Republic of China. Updated June 23, 2014. Accessed January 27, 2024. http://www.moe.gov.cn/srcsite/A03/moe_1892/moe_630/201406/t20140623_170737.html
16. [Notice on Printing and Distributing the Implementation Plan of the National Vocational Education Reform]. Ministry of Education of the People's Republic of China. Updated January 24, 2019. Accessed January 28, 2024. http://www.moe.gov.cn/jyb_xxgk/moe_1777/moe_1778/201904/t20190404_376701.html
17. Liu ZJ. [Policy evolution, development logic and path direction of tertiary vocational education in China]. *Vocat Tech Educ.* 2021;42(26):6-10.
18. Han Y. [Core elements and construction paths of the digital governance system of vocational education]. *China Vocat Tech Educ.* 2023;(04):36-42+61.
19. Chen W, Yi FY. [Reflection on the practical logic of industrial college governance]. *Jiangsu Educ.* 2021;(89):6-15.
20. Zhou MM. [The development logic, current dilemma and way forward of high-quality vocational undergraduate education]. *Educ Occup.* 2022;(24):59-64.
21. Wang J. [Research on the connotation and construction path of vocational undergraduate education]. *J Tianjin Vocat Univ.* 2022;31(06):52-56+75.
22. [Higher Vocational Education Annual Quality Report 2023]. Guangdong Business and Technology University. Updated December 30, 2022. Accessed June 14, 2023. https://jxzljk.gdbtu.edu.cn/channels/2293.html
23. Bie DR. [Development logic and practical strategy of tertiary vocational education]. *J Shenzhen Inst Vocat Tech.* 2023;(1):9-16.
24. Luo XQ, Li XH. [Exploring the connotation, positioning and development path of tertiary vocational education]. *Educ Career.* 2023;(4):21-27.
25. Guo GJ, Li Y, Liu YQ. [Educational objectives, key features and promotion strategies of high-quality tertiary vocational education]. *Educ Career.* 2022;1022(22):44-47.
26. Luo N. [Research on the running mode of vocational undergraduate pilot universities—taking Guangxi City Vocational University as a case]. Nanning: Guangxi University. 2021. (Thesis)
27. Lu YZ, Zeng TS. [Implications and action strategies of vocational undergraduate education practice]. *Univ Educ Sci.* 2023;(3):108-117.
28. Zong C. [Exploration on the development path of vocational undergraduate education]. *Res Higher Educ Eng.* 2022;(06):141-145.