

# Analysis and Countermeasures of The Problems Existing in The Collaborative Education Curriculum System on Higher Vocational and Undergraduate Education of "2+2" Applied Undergraduate

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## Abstract

Based on the cooperation between the major of Mechanical Manufacturing and Automation of Guangdong Vocational and Technical College of Industry and Trade and the College of Mechanical and Electrical Engineering of Lingnan Normal University, this paper analyzes the existing main problems of the "2+2 sub-section", and summarizes the teaching system and teaching evaluation of the training quality of the mechanism of specialized textbook docking. Developing vocational undergraduate education in multiple ways and dealing with the connection between higher vocational and undergraduate courses, the teaching system provides a reference for the development of other specialized teaching systems and has important reference significance.

## Keywords

Applied undergraduate; Manufacturing major; Subparagraph 2+2; Curriculum system.

## 1. Introduction

In order to meet the growing needs of the society for undergraduate talents, in recent years, the outstanding graduates of higher vocational colleges have entered the undergraduate course of study. In May 2021, the Ministry of Education issued a notice of "upgrading to higher education and expanding enrollment" for two consecutive years, which means that the number of students in provinces across the country will continue to increase. In 2022, enrollment will continue to increase on a stable basis. The examination opens up the bridge between junior college and undergraduate education, creates opportunities for vocational college students to continue their studies, and also improves the quality of talent training, increases the learning enthusiasm of vocational college students, and improves the quality of employment of students. However, due to the different training goals set by higher vocational education and undergraduate education, vocational students are prone to problems such as unsatisfactory acceptance of theoretical courses when they enter undergraduate colleges and universities to receive undergraduate education. With the increasing enrollment of college students in recent years, the increasing number of college students cannot be ignored in the process of higher education.

Existing studies have shown that in the "3+2" pilot practice between higher vocational college and general undergraduate, vocational education and vocational skill training are still carried out in accordance with the talent goal of higher vocational education, rather than the basic knowledge and ability requirements of undergraduate level courses. After entering the undergraduate college, students have to spend two years studying the basic courses and specialized courses that originally cover four years of higher theoretical levels and

requirements. On the one hand, the content is partially repeated, wasting educational resources; On the other hand, students in the undergraduate stage of heavy pressure, weak ability, learning effect is not good. The "2+2" specialized transfer model of American community college gives inspiration to this project. American community college "2+2" specialized section of the model, that is, by the community college transfer education and undergraduate professional education composition, the first two years to provide university bachelor's degree of general education courses, complete the credits to obtain an associate degree, transfer to the community college signed a cooperation agreement with the undergraduate institutions to complete higher vocational education. Transfer education in community colleges and professional education in undergraduate colleges ensure the convergence of courses through the same requirements of talent training goals and curriculum system design under these goals. By means of cooperation agreements, community colleges sign core courses of transfer education with ordinary colleges and universities, determine the requirements of high-quality development of national education in the new era and the modernization of education in Guangdong province, adhere to the school's "teacher-oriented, teaching-oriented, local and application-oriented" orientation, cultivate noble professional ethics, and have rich humanistic, scientific and artistic qualities. Solid discipline and professional foundation, strong practical ability, moral, intellectual, physical, American and labor all-round development of high-quality applied talents training goals. This "2 years (basic) +2 years (professional)" model, both practical and balanced segments, is more conducive to reflecting the continuity of the specialization.

## 2. Research Methods

Problems existing in the "2+2" professional curriculum system

### 2.1. The course content is repeated

Due to the similar majors after graduation, the curriculum knowledge system of junior college and undergraduate is repeated and the course content is not connected. The goal orientation and content of talent training are different between higher vocational colleges and ordinary colleges. Therefore, higher vocational colleges focus on cultivating technical talents who not only understand professional knowledge in a certain vocational field, but also have practical operation ability, focusing on cultivating students' practical and practical ability, while undergraduate colleges pay more attention to students' knowledge reserve and scientific research level, mainly cultivating high-level scientific researchers to build the country. Therefore, although students have learned similar theoretical basic courses of their major in the stage of higher vocational education, the depth, difficulty and breadth are completely different from the undergraduate basic courses of the same major. Higher vocational education and general undergraduate education for the same or similar professional two completely different talent training models, it is easy to cause the two stages of some theoretical basic courses and professional courses overlapping phenomenon. In order to meet the requirements of graduation, students need to complete all courses. On the one hand, it wastes the precious time and energy of students, causes extra learning burden to students, and is not conducive to the effective connection and communication of knowledge system. On the other hand, it causes the waste of teaching resources, which is not conducive to the cultivation of students' initiative in independent learning.

### 2.2. The traditional teaching method is single

It is not difficult to find that the teaching method and teaching form are unitary in the course of our country's "upgrading from junior college to junior college" education. At present, after most vocational college students enter the undergraduate stage, their learning is basically still

dominated by teachers and students' passive learning, ignoring the process of learners' independent learning and self-study. In the process of "higher education" training in China, there is no development of theoretical and application-oriented courses, theoretical courses are still carried out according to the requirements of undergraduate colleges, and application-oriented and practical courses are also carried out according to higher vocational colleges, especially the enrollment of "2+2" collaborative education. In terms of talent training programs or relevant curriculum standards, almost all of them are in the stage of exploring independently in practice, and curriculum development is still hovering at the micro level, not rising to the middle and macro levels. It is still unable to mobilize the enthusiasm of learners, and it is difficult to improve their practical ability and innovative quality.

### **2.3. The practice part of the training model is insufficient, and the school-enterprise cooperation is not deep enough**

At present, although school-enterprise cooperation is involved in the training of specialized textbooks in our country, due to various objective conditions, especially the different starting points and goals of schools and enterprises, the depth of school-enterprise cooperation in specialized textbooks is not enough, which makes the training mode of school-enterprise cooperation "formalized" seriously. When providing practical resources, some enterprises mostly use the specialized students participating in practice as low-end production resources and carry out simple and repetitive work, which cannot achieve the training goal of compound talents. In the training mode of specialized students, the school's own reasons and the lack of close cooperation between schools and enterprises lead to the lack of training of practical ability of specialized students, which can achieve the fundamental purpose of cultivating specialized education and meet the needs of the transformation and upgrading of manufacturing industry.

## **3. Results**

Further promote the work strategy of the pilot development of collaborative education of mechanism specialized courses

### **3.1. Strengthen the connection management of the talent training process of pilot projects**

The establishment and application of teaching standards and curriculum standards for professional talents in the pilot project of collaborative education is an important link to link up the collaborative education project of higher vocational college undergraduates. The arrangement of the curriculum system, the requirements of the curriculum teaching standards and the formulation of the course hours are mainly led by the undergraduate colleges, and the vocational colleges and enterprises cooperate to complete the talent training program. On the basis of social talent needs to determine the training objectives of mechanism majors, and on the basis of vocational ability and professional quality required by mechanism majors, an integrated curriculum system and curriculum standards are established. The convergence of curriculum system is the fundamental guarantee to realize the convergence of professional talents training in higher vocational colleges, and the core of curriculum teaching standards is the construction of the integrated convergence of curriculum system. In order to ensure the scientific formulation of the curriculum system and curriculum standards, the following basic principles should be followed: First, the university (higher vocational college) should cooperate, and the undergraduate and higher vocational college should cooperate to formulate the two stages of talent training objectives. The second is the cooperation between schools and enterprises, and the machinery manufacturing industry and enterprises participate in the whole course standard development process. Thirdly, professional ability and professional

quality as the core, determine the professional core curriculum content of higher vocational college, and establish the specialized curriculum system in modular form. The fourth is to realize the connection between the teaching process of practical courses and the actual production process.

### **3.2. Strengthen the joint construction of the management mechanism of collaborative education and training**

The professional teaching committee shall be jointly established by the higher vocational colleges and the undergraduate colleges. The professional teaching committee shall be composed of the deans of the two secondary schools, the deputy deans in charge of teaching, the deputy secretaries of student affairs and the person in charge of the major. The professional teaching Committee shall establish the connection management of teaching methods, assessment and evaluation, teaching management and student management. To achieve the undergraduate higher vocational education in moral education, professional skills education, quality education, innovation and entrepreneurship education and employment guidance and other aspects of collaborative training and precise docking.

### **3.3. The teaching system is the key link to achieve the goal of talent training and the core content of the talent training system.**

Considering that the pilot work of collaborative education for higher vocational undergraduate students adopts a segmented training method, it is necessary to make a systematic, division of labor, from shallow to deep, step-by-step overall planning for the teaching system of higher vocational undergraduate students, and promote the reform of the integrated teaching system of teaching standards, teaching content, teaching methods, teaching teams and teaching evaluation. To realize the organic integration and effective connection of the two systems of undergraduate major and higher vocational major, and effectively improve the quality and level of higher vocational undergraduate talent training.

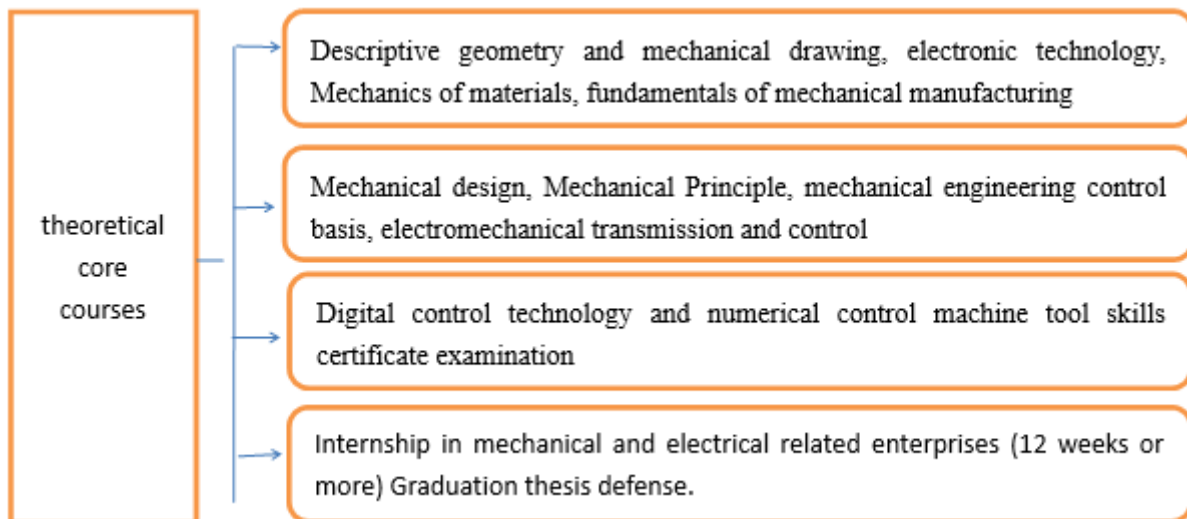
Colleges have theoretical advantages and teacher advantages, vocational colleges have practical training advantages, industry associations and other practical resources advantages, and the synergistic cooperation between the two sides can produce the effect of superposition of advantages. By deepening the reform of application-oriented personnel training mode, it will guide and promote the transformation and development of application-oriented colleges and universities, and improve the ability and level of higher education to serve regional economic and social development.

The teaching system has a clear hierarchy, and a multi-level practical teaching system has been established(as shown in Table 1), including classroom professional curriculum school (as shown in Figure1, extra-curricular practice group, extra-curricular innovation activities, curriculum experiment, comprehensive design experiment, research innovation experiment, etc., to achieve a reasonable connection between practical teaching and theoretical teaching. In the process of talent training, the functions of each level are clear. The basic ideas that embody the coordinated development of knowledge, quality and ability are shown in Table 2 and Table 3.

The strict engineering training process and the concentrated practice design are the concentrated training of students' design ability, comprehensive ability and independent working ability. Over the past few years, we have been working hard to create a field simulation environment in the campus practice base, so that the concentrated practice links carried out in the base can imitate the actual engineering process as much as possible, and realize the full realization of the design, production, installation and debugging process.

**Table 1.** Graduation requirements and their connotation analysis table

Graduation requirement	connotation analysis
Engineering knowledge	Master mathematics and natural science knowledge, have the foundation of engineering problem expression, establish mathematical models for specific objects and solve. Basic and professional knowledge of mechanical design and manufacturing, able to describe the function and performance of units (components) or systems. Master the basic and professional knowledge of electromechanical, transmission and control, and be able to analyze and evaluate the operation and control of mechanical systems.
Problem analysis	Use the scientific principles and technical methods of the professional direction to identify and judge the key links of complex mechanical engineering problems. Through the literature search and research of complex mechanical engineering problems, analyze the influencing factors of the process, seek a variety of solutions, and obtain effective conclusions.
Design/development solutions	Master the basic principles and methods of technological innovation, reflect the consciousness of innovation in the design process, and consider social, health, safety, legal, cultural and environmental factors in the design plan.
Research	The research can use scientific methods to analyze complex engineering problems, select research routes according to the characteristics of the problems, and design and implement experimental schemes. Master the observation, measurement and data acquisition methods of experimental results and the use of tools, process and analyze experimental data, and form effective experimental conclusions.
Master professional	Master professional related modern engineering tools and information technology tools, understand their characteristics and limitations, and apply to complex mechanical engineering problem analysis, calculation, etc. Develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools, etc., to design and implement electromechanical devices or works.
Engineering and Society	Understanding of the social responsibilities of mechanical engineers, the ability to identify the social, health, safety, legal, cultural and environmental impacts of engineering practices, and the socio-cultural impact of engineering practices.
Environment and Sustainable development	To understand and evaluate the potential impact of mechanical engineering practices on ecological, economic and social sustainable development. Be familiar with relevant policies, laws and regulations, reduce the impact of threatening human and environmental factors when proposing solutions to complex mechanical engineering problems, and consciously maintain the environment and sustainable development.
Professional norm	Understand the social value of mechanical engineering technology, have a sense of social responsibility, be able to comply with engineering ethics and norms in engineering practice, and consciously fulfill the social responsibility for public safety, health and well-being, as well as environmental protection.
Individuals and teams	Individuals and teams are able to understand the relationship between individuals and teams in a multidisciplinary context, as well as their role as team members and leaders.
communication	Be able to express your views orally and in writing, respond to instructions and queries, and communicate effectively with industry peers and the public on complex mechanical engineering issues. Able to write standardized reports and design documents, able to express clearly and make presentations. Master a foreign language, have a strong reading and writing ability of foreign language professional materials; Have a certain international perspective and be able to communicate and exchange ideas in a cross-cultural context.
Project management	Have the knowledge of project management and economic decision-making required in the process of project implementation, and understand the problems involved in project management and economic decision-making. The ability to apply engineering management and economic decision making methods to the design of solutions in a multidisciplinary environment.
Lifelong learning	Lifelong learning can recognize the necessity of career planning and the importance of lifelong learning in the context of social development. Understand the cutting-edge development status and trend of the machinery industry, mainstream technology needs, with good independent learning and lifelong learning ability, can adapt to social development.



**Figure 1.** 2+2 talent training four-year core curriculum block diagram

**Table 2.** Weekly class hours arrangement for each semester of education and teaching in the fourth academic year

Course category			Commencement term							
			I	II	III	IV	V	VI	VII	VIII
Public curriculum	Compulsory course		9	8	8	5.5				
General education courses	Compulsory course		5	3						1
	Elective course		1	2	3	2				
Subject specialized curriculum	Subject specialized curriculum	Compulsory course	11	20	12	8	8			
		Elective course	2	6	8	16	14	8		
	Vocational education curriculum	Restricted course					2	14		
		Optional course						2		
Integrated practical curriculum			3w	2w	3w	4w	3w	4w	19w	10w
Number of school hours per week			29	40	32	32.5	25	25	1	2

**Table 3.** Distribution of teaching time in four academic years for mechanical design, Manufacturing and automation undergraduate majors

Academic year and semester Weeks Educational activities	I		II		III		IV		total
	1	2	3	4	5	6	7	8	
total weeks	19	20	20	20	20	20	20	17	156
Lectures (including practice and assignments)	14	16	16	16	16	16	3	14	111
maneuvering		1	1	1	1	1	1		6
examination	2	2	2	2	2	2		1	13
Military skill	2								2
Labor and social practice	1	1	1	1	1	1			6
Professional internship	(1)		(1)		(1)		(1)		4
Graduation practice							15		15
Graduation Thesis (Design)								(10)	10
Graduation education								2	2

#### 4. Conclusions

At present, there are still some controversies about the goal of professional cooperative education in ordinary undergraduate colleges and universities, and there is also a profound homogenization of "general-professional" in the talent training program, and there are many inappropriate training modes, curriculum Settings and teaching methods. Colleges and universities need to further clarify the training standards and objectives of talents, adjust and optimize their talent training programs, break the inherent curriculum model and evaluation methods, and deeply cooperate with undergraduate theoretical teaching and practical teaching in higher vocational schools and enterprise practice. Establish a result-oriented multiple evaluation system, focusing on improving students' teaching skills and employability, and focusing on practical effect detection. At the same time, the current curriculum objective system and teaching process should be improved to form a virtuous cycle structure of "teaching-learning-evaluation" for curriculum objectives, teaching activities and teaching evaluation, and real-time data monitoring of the teaching quality under the closed-loop teaching structure should be carried out to achieve the purpose of continuous improvement of teaching quality. So as to deepen the teaching reform of the major of machinery manufacturing and automation in our school, improve the innovation ability and employment competitiveness of the students of machinery manufacturing and automation in our school.

#### 5. Conflict of Interest

The authors have declared no conflicts of interest.

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