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Modular construction of teaching mode of innovative talents training under the background of integration of industry and education

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Abstract: In order to improve the teaching effect of innovative talents training, a modular innovative talents training teaching mode is constructed under the background of integration of production and education. First, analyse the problems existing in the modular teaching mode, and then analyse the causes of the problems. Second, determine the necessity of the integration of modular production and teaching. Finally, explain the connotation of the categorical teaching modular relationship, analyse the main factors of talent cultivation by using the analytical method, and construct a modular teaching mode by combining consistency and coverage indicators. The case analysis shows that the consistency of conditional variables does not reach 0.9, which indicates that variables are not necessary for high performance. After the application of this model, students' scores have been improved by more than 10 points, and the proportion of difference in scores has reached 0.14, which verifies that this model has a higher teaching effect.

Keywords: consistency; coverage; integration of industry and education; cultivation of innovative talents; necessity analysis; modularisation of teaching mode.

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1 Introduction

The integration of industry and education is a vocational education mode, in which industry and education are the practical application needs of industry, industry and application, and its application nature is emphasised; Teaching means education, teaching, and other vocational education links, including vocational colleges and universities, as well as education departments and other units (Li and Lin, 2019; Li et al., 2022). Integration refers to the effective combination of industrial practice and vocational education system, and the establishment of a vocational education system that meets the needs of the industry. At the same time, the teaching and scientific research activities of vocational education institutions can also be nurtured and tested in the industry, so as to jointly create high-tech professional talents for China's economic and social development. The concept of integration of industry and education is not put forward separately. It is the product of cooperation among vocational colleges, industries and enterprises. The integration of industry and education of vocational education is mainly divided into three levels of relationship categories, which must have a positive interaction with the sustainable development of society. The first is the relationship at the macro level. The establishment of the vocational education system needs to be combined with the national strategic planning for the economy and society and the industrial development trend (Huang et al., 2022). The second is the relationship between departments and institutions. The integration of production and education in vocational education is not a simple skill education. It is mainly composed of various government departments, schools, educational institutions and other units around vocational education and industry. In the process of carrying out vocational education, it needs the close coordination of various departments to jointly formulate a vocational education plan and form a mutual cooperation and promotion system. Finally, at the micro level, vocational colleges need to adjust and set up professional courses, teaching methods, practice processes and other teaching activities according to the characteristics and specific needs of industries and industrial enterprises, and connect with industrial links to achieve symbiotic and integrated development.

In order to improve the teaching effect of innovative talents training, this paper analyses the teaching mode of innovative talents training under the background of integration of production and education, and constructs a modular teaching method. The design scheme is as follows:

1 *Analysis of the problems in the training of talents with modular integration of industry and education*: Analyse the problems in the training of talents with modular integration of industry and education, such as the idea of school enterprise

cooperation with modular integration of industry and education has not been implemented, and the industry and curriculum teaching system for the training of talents with modular integration of industry and education have been dislocated.

2 *Analysis of the causes of the problems in the training of talents for the integration of modular industry and education*: Detailed analysis of the causes of the problems in the training of talents for the integration of modular industry and education, such as the deviation of the school enterprise cooperation fit for the integration of modular industry and education.

3 *Analysis on the necessity of modularisation of talent training teaching mode in the integration of industry and education*: This paper expounds the necessity of modularisation construction of innovative talent training teaching mode in the context of integration of industry and education, such as the need of modularisation teaching for talent training in local vocational colleges.

4 *Modular construction of innovative talent training and teaching mode*: According to the reasons of the above analysis and the necessity of building a modular talent training model based on integration of production and teaching, from the modular connotation explanation of the relationship between innovative talent training and teaching mode based on categorisation, the modular analysis of innovative talent training and teaching mode based on qualitative comparative analysis On the innovation of the modularisation of talent training teaching mode in higher vocational colleges under the background of the integration of industry and education; the modularisation method of innovative talent training teaching mode under the background of the integration of industry and education.

5 *Case analysis*: Design case analysis scheme, prepare case, calibrate data and assign variables, and analyse case results after completing the above steps.

6 *Conclusion*: Summarise the general summary paper, explain the research background of modular construction of innovative talent training teaching mode under the background of integration of industry and education, briefly explain the research methods, and explain the results of case analysis to draw conclusions.

2 Analysis of problems in the cultivation of modular talents with integration of production and education

2.1 Concept of modular integration of production and education and school enterprise cooperation has not been implemented

The modularisation of the teaching mode of integrating production and education can cultivate application-oriented talents, realise the concept of mutual benefit and win-win for Vocational Colleges and enterprises, and achieve win-win results for all parties. This is in line with the development needs of the market economy, can accelerate the industrial upgrading and transformation, and is an important way for the school to continuously train talents. Although the concept of integration of production and education is accepted by many enterprises and vocational colleges, there are still many

problems in the modularisation of the current production and education integration training mode due to the lack of depth of the concept (Tian and Muhammadtalal, 2022).

There are two main deviations in the concept of school integration: first, some vocational colleges have different attitudes towards large enterprises, small enterprises and private enterprises. Many vocational colleges and universities are willing to cooperate with state-owned enterprises and large enterprises, and pay little attention to small enterprises or private enterprises. This kind of integration concept is very one-sided and is not conducive to the cultivation of talents with integration of industry and education. At the same time, this problem also reflects that many vocational colleges have "high eyes but low hands", which makes them deviate from the concept of integration of production and education. If some schools do not change this misconception as soon as possible, there will be no way to achieve a win-win situation for enterprises and schools. This is also a reflection of the lack of depth of the talent training concept of combining production and education. If vocational colleges blindly seek to cooperate with large enterprises and ignore small enterprises, they will eventually put the enterprises in a desperate situation and even endanger the future development of the school. Second, some vocational colleges mistakenly understand the integration of production and education as solving students' practice problems or employment problems, and fail to recognise the important role played by enterprises in the process of integration of production and education. Some colleges and universities consider their own interests more, and do not fully consider that the integration of production and education requires the joint efforts of enterprises and schools, and need to explore and build a teaching mode oriented to the cultivation of innovative talents (Lu, 2020). As for deeper understanding, how to better serve the enterprise, how to set up courses, and how to listen to the suggestions of the enterprise all require the school to constantly change the integration concept.

2.2 Industry of modular integration of industry and education and the dislocation of curriculum teaching system

From the perspective of the current talent training of the integration of industry and education, the school education and the enterprise talent demand are low (Bian and Wang, 2020), and even disconnected. The main reason for this situation is that the modular teaching and industry of the teaching mode of integration of industry and education and talent training are out of touch, and the degree of coincidence between the two is low. This problem is mainly manifested in two aspects.

(1) *The depth of enterprise industry education integration participation is not enough*

At present, the integration of production and education follows such a process: first, school training and second, enterprise practice. The degree of integration between enterprises and schools in production and education integration is not enough, and the depth of integration needs to be strengthened. The lack of integration is mainly manifested in two aspects: one is the lack of integration of cooperation forms and the other is the lack of integration of training objectives. The lack of integration has led to the current integration of production and education in the modular training of talents. In addition to the comprehensive quality, the general ability and technical ability are not high, that is, the practical ability of talents trained by universities is insufficient (Zong,

2020). This further shows that the demand for enterprise talents is out of line with the training objectives of the school. Finally, the students are unable to work in the enterprise after joining the enterprise.

(2) *Insufficient implementation of the training objectives of Applied Talents in schools*

In the actual implementation process, many policies and objectives have changed, and they are not trained in strict accordance with the established objectives. Many training objectives are not really implemented. Some vocational colleges still "advocate new slogans, practical old slogans", lack of innovation (Zheng, 2020; Yin, 2021), and the objectives are not implemented in place. As a result, the integration of industry and education cannot be realised, and the talent training is out of line with the needs of enterprises. Some schools attach importance to knowledge teaching, but neglect practice; While some schools attach importance to practice, but ignore theoretical knowledge. Both of these two extremes are undesirable and contrary to the goal of cultivating applied talents.

2.3 No guarantee for the training of talents with modular integration of production and education

There are still many problems in the guarantee of personnel training for the integration of industry and education, such as insufficient support and imperfect training policies. Although these problems exist, they cannot be an obstacle to the integration and transformation of industry and education. We should break through these problems from the system.

(1) *Lagging behind in policy support*

First, small and medium-sized enterprises hold a wait-and-see attitude towards the integration of industry and education. Some small and medium-sized enterprises are unwilling to participate in the modular teaching mode of integration of industry and education. On the one hand, this is due to the poor integration of production and education in small and medium-sized enterprises and vocational colleges, and on the other hand, there is no encouragement and support from relevant policies. For small and medium-sized enterprises, their comprehensive strength is not as strong as that of large enterprises, and their enterprise scale is not as large as that of large enterprises. Compared with large enterprises, their capital chain and anti-risk ability are limited. The cultivation of talents with integration of industry and education is a long-term investment of talent reserve, and there is no immediate return. Moreover, this talent investment is risky and the return cannot be judged. This situation discourages many small and medium-sized enterprises, which have no extra energy and funds to participate in the training of industry education integration talents. Second, the national laws and regulations do not provide policy support for SMEs to participate in the integration of industry and education, but only issue guidance to promote the training of talents in the integration of industry and education. Faced with such a market environment, many small and medium-sized enterprises dare not participate in the integration of industry and education.

(2) *Insufficient financial mechanism support*

There are various sources of funds for vocational education, including enterprises, industry organisations and public welfare organisations. These organisations support vocational colleges by giving them funds, purchasing equipment or research and development of teaching resources (Chu, 2021). However, there is less support for student training funds, and the state and government still give certain economic input, such as support for scientific research projects (Yi et al., 2020). All organisations should strengthen their support for Vocational Colleges and universities, and increase investment in personnel training funds. At present, when it comes to the integration of industry and education, many fund applications are very complicated, there are many procedures, the approval process is slow, and there are many materials that need to be submitted repeatedly. These problems are very prominent, and there is no way to meet the needs of integration of industry and education. Eventually, the cooperation between enterprises and vocational colleges will be deadlocked, and the training of application-oriented talents will be trapped.

3 Analysis on the causes of the problems in the cultivation of talents with modular integration of production and education

After clarifying the problems in the training of talents with integration of industry and education, it is necessary to further analyse the causes of the problems, so as to facilitate the modular construction of the teaching mode of innovative talents training under the background of integration of industry and education and provide a theoretical basis for it.

3.1 There is deviation in the school enterprise cooperation fit of modular production education integration

According to the above analysis, On the one hand, in China's vocational education system, the talent training mode of integration of production and education has been implemented for many years and has achieved certain results, but there are still problems of cooperation concept. The modular construction of the talent training and teaching mode of the integration of industry and education needs the coordinated efforts of multiple resources. During this period, it needs to continuously provide the support of financial resources, material resources and other related resources. As an important subject of the modular system of the talent training and teaching mode in the integration of industry and education, the enterprise will inevitably increase the huge economic cost for the enterprise if it goes deep into the school running of the integration of industry and education, The income that enterprises can obtain mainly comes from the government's economic subsidies and tax reduction. However, some talents trained by the integration of production and education cannot be fully absorbed by enterprises. Meanwhile, the enterprise's investment in the modularisation of the teaching mode of the integration of production and education needs a certain time to be reflected in the economic benefits, which leads to a negative impact on the enterprise's enthusiasm for the integration of production and education.

On the other hand, the wave of enterprise restructuring in the 1990s led to the disintegration of the original school enterprise cooperation relationship dominated by

enterprises. Some strong vocational colleges were highly absorbed or upgraded to independent colleges in the wave of efficient merger, while some weak vocational colleges were separated from the vocational education system led by government departments, losing their close relationship with the original industry enterprises, At the same time, some newly-built vocational colleges also lack the background of industrial enterprises, and there is no clear one-to-one relationship between them and the modularisation of the teaching mode of integrating production and education. There are still barriers to the real realisation of integration of production and education.

3.2 The development priorities and demands of both parties are inconsistent

(1) *The development priorities of industry and education are quite different*

The focus of enterprise development is development. In order to achieve better development, the enterprise will expand its scale, expand production, pursue profit growth, and maximise its own interests. While the focus of school development is to educate people (Kang and Tang, 2021; Dou et al., 2020), and it bears certain social responsibilities. How to deliver excellent talents to society and enterprises is the most important task of school development (Liu et al., 2020). By comparing the development goals of enterprises and schools, we can see that there are great differences between the two development goals. The different goals pursued by enterprises and schools lead to different emphasis on the integration of industry and education. Enterprises are unwilling to invest energy and financial resources in running schools, and want to use these capital to expand reproduction, expand their business scope and increase income. The school has invested more in the modularisation of the teaching mode of integrating production and education, and has invested more energy and undertaken more responsibilities. The inconsistency between the development goals of enterprises and schools will lead to the establishment of the modular curriculum system of the production and education integration talent training teaching mode, which cannot really meet the actual needs of industry and industry enterprises.

(2) *The interests of both parties are not unified*

The integration of industry and education is only an important work direction under the guidance of relevant national policies. In addition to the cooperation between schools and enterprises in personnel training, vocational colleges have other responsibilities and missions. Vocational colleges pay more attention to the completion of teaching work and the evaluation work of education authorities. Therefore, in the specific cooperation between schools and enterprises, there are differences in the degree of work fit between the two sides. On the one hand, enterprises pay more attention to the issue of income. In the process of enterprise development, vocational education is needed to cultivate a batch of talents with basic skills to fill the job vacancies. If these skilled talents are recruited by the society, they will need to spend a lot of time and energy. The cooperative education with vocational colleges can bring continuous and stable talent input to enterprises. On the other hand, in the process of production and education cooperation with enterprises, vocational colleges do not take profit as the goal, and the ability of vocational colleges as educational units to directly realise economic benefits is also very limited. From the perspective of national support, it is difficult for some tax exemptions or financial subsidies to bring considerable revenue for the development of the school. Therefore,

from the perspective of the interests of vocational education and enterprises, there are differences in the interests of the two, and the behaviours of the corresponding actors are also different, resulting in the enterprises' low initiative and enthusiasm for the integration of industry and education, insufficient participation in the formulation of relevant curriculum systems, and only financial support for some scientific research projects (Leech and Anne, 2021).

3.3 The construction of relevant policies and guarantee systems lags behind

The level of integration of industry and education in vocational education is not high, and it is at the simple level of "opening an opening, doing some practical training, buying some equipment, and engaging in some competitions". The deep reason is the lack of relevant policy guarantee system. The incompleteness of these top-level designs has brought difficulties to the implementation of the modularisation of the teaching mode of the integration of production and education in vocational schools, and there is still a certain gap from truly meeting the objective needs of the integration of production and education. In addition, due to the imbalance of development resources such as the existing material foundation, geographical conditions, the importance attached by local governments and the difference in the investment of industrial enterprises, the development mode and level of integration of industry and education among higher vocational colleges are different. From the analysis of the type and nature of running schools, there is a competitive relationship among higher vocational colleges, especially in the same region, such as Liaoning Province. At present, many higher vocational colleges have similar majors, but the resources in the same region are relatively limited. There are competitions among Higher Vocational Colleges in terms of enrolment, winning government funding support, and seeking cooperative enterprises. This characteristic determines the competition among Higher Vocational Colleges in some areas, especially those with similar nature of running schools and specialties. As a result, the development resources among higher vocational colleges are not balanced, the level of integration of production and education is not balanced, and the classification of supporting resources is inevitably uneven and insufficient.

4 Analysis on the necessity of modularisation of the teaching mode of the integration of industry and education

The above analysis has analysed the existing problems and the causes of the integration of production and education personnel training, but only completing this analysis cannot explain the necessity of modularisation of the teaching mode of the integration of production and education personnel training. Therefore, the importance of the analysis can be analysed to construct a new modular teaching mode.

4.1 Need of talent training in local vocational colleges with modular teaching

Through the above analysis, we can know the importance of modular construction of innovative talent training and teaching mode in the context of industry education integration, and the necessity of building a modular talent training and teaching mode of industry education integration is mainly reflected in the needs of modular teaching in

local vocational colleges and the needs of local regional economic development. First, we will elaborate the needs of modular teaching in local vocational colleges. The source of students in higher vocational colleges is directly related to the quality of employment. To a certain extent, the quality of the source of students affects the employment rate of graduates in higher vocational colleges. The quality of employment is often positively related to the quality of students. Whether a school can adapt to the development of the times depends on the school's contribution to society. The improvement of employment quality is conducive to the school's good influence on who will produce good social benefits. Improving the quality of employment in higher vocational colleges is very important for the development of a higher vocational college. Practice tests the truth. When cultivating talents, we need to teach students according to their aptitude. Only by combining theory with practice can we improve the professional ability of students after graduation. Higher vocational colleges should make training plans, plan training directions and formulate talent training objectives for students in accordance with market demand. At the same time, reasonable allocation of teaching resources and accurate teaching evaluation are also crucial to whether higher vocational colleges can train high-quality talents to enter the market, this is also the purpose of developing the modularisation of talent training teaching mode.

In our country, many higher vocational colleges often fail to meet the expectations of the students and parents in the level and characteristics of the higher vocational colleges. The reason is that higher vocational colleges have not made significant reform in the modularisation of talent training teaching mode. They still follow the traditional teaching methods in the past and have not found a suitable way for themselves. Instead, they copy the talent training ideas of the major undergraduate colleges. A great disadvantage of this is that it not only fails to catch up with the development of undergraduate institutions, but also directly leads to the concealment of the specialties and advantages of vocational schools. Therefore, the allocation of teaching resources and accurate teaching evaluation will not be realised, and the modularisation of the talent training teaching mode of integrating theory with practice will only become empty talk. The final result will be that vocational colleges will not be able to train high-quality talents that meet the market demand and the needs of the workplace, which will directly affect the employment quality of Vocational Colleges and ultimately limit the self-development of vocational colleges. It is obvious that the deep cooperation between schools and enterprises to train students, actively connect with the market, investigate and analyse the market demand, and take the integration of industry and education as the starting point, can scientifically and effectively promote the transformation of the education system of Higher Vocational Colleges and further improve the talent training mode of vocational colleges, give full play to the advantages of local higher vocational colleges, and promote the development of local industrial economy by turning the adverse trend into an advantage.

4.2 Needs of local and regional economic development

All enterprises urgently need talents with high vocational skills to help them develop rapidly. According to the current structure of the talent market, China is extremely short of high vocational skills talents, and opportunities are both challenges. The major vocational colleges need to learn as much as possible about the economic development structure and development situation of their cities, develop their own unique teaching policies and implement relevant education models in combination with the information

they know, To continuously supply talents with high professional skills for local enterprises, so as to achieve mutual benefit and win-win results between schools and enterprises, synchronous development and common progress.

The shortage of applied and technical talents is a common phenomenon in China's talent market, which is caused by the excessive theoretical curriculum education in China's higher vocational education and the failure to combine the goal of talent training with the industry and market. This education mode cannot meet the needs of China's current economic development. Therefore, the urgent task is for the government to start from a higher strategic goal, pay more attention to the training of skilled and technical talents, build a modular teaching model, emphasise the necessity and importance of industrial transformation in China, and realise the training of skilled and applied talents in Higher Vocational Colleges through the concept of integration of industry and education and the way of school enterprise cooperation. This is an inevitable process for Higher Vocational Education in China.

5 The modular construction of the teaching mode of cultivating innovative talents

5.1 On the connotation of modularisation in the teaching mode of cultivating innovative talents based on categorisation

After completing the above analysis, based on the analysis results, a modular teaching model for innovative talent training is constructed. The modular teaching mode is called "broad foundation and flexible module" teaching mode. It starts from the educational concept of people-oriented and comprehensive education, and according to the training requirements, through the flexible and reasonable combination of module courses, it first trains students' broad basic humanistic quality and basic professional ability, and then trains their qualified professional ability, This modular teaching model is more suitable for our education than the "task module" and "ability module" in foreign countries. On the other hand, categorisation is the process of classifying concepts on the basis of the template formed by conceptualisation, that is, analysing related concepts in a deeper level, merging the same points in existing concepts, and refining the initial categories, so as to further enrich the case materials; The key is that the categories formed are related. In the process of categorisation, if it is found that the conceptual naming is a combination of multiple properties and dimensions, it is no longer necessary to abstract it, and it can be directly regarded as a category; If there is a phenomenon that the correlation between certain categories cannot be found, it is necessary to further increase case materials and enrich the categories on this basis until a clear vein can be found between the categories to connect them. Adhering to the idea of sampling and comparison, after labelling, conceptualising and categorising the case materials, this study has extracted a total of 15 initial categories, including enterprise motivation, school motivation, goal setting and academic guidance. Table 1 shows the corresponding relationship between the initial category and concept of the modularisation of talent training teaching mode and the relationship connotation of the initial category.

Table 1 Categorisation of modularisation of talent training teaching mode and explanation of its relationship connotation

Concept	*Initial category*	*Relationship connotation*
Develop technology and reserve talents	Enterprise power	Enterprises participate in the integration project of industry and education mainly for the purpose of developing technology and reserving future talents of enterprises
Training students and scientific research	School motivation	The school's participation in the project of integration of production and education is mainly to train students and carry out scientific research
Industrial development, discipline development and talent demand	Policy incentives	Led by the external subject of industry and education with the government as the core, it explains the current situation and prospects of industry and discipline development and the resulting talent gap through a series of policies
Capital investment and financial inclination	Financial incentives	The government uses the financial system represented by tax and credit incentives, as well as the direct investment of funds to schools or enterprises, to give financial incentives to the industry and education
Landing execution	Executive Incentives	Third party entities other than industry and education promise to provide guidance and support to schools and enterprises in the project
Talent training objectives and other objectives of the project	Set goals	After the production and education parties have expressed their willingness to cooperate, they shall jointly formulate the objectives of the project in terms of personnel training, output of achievements, commercial realisation, etc.
Cooperation mode and benefit distribution mechanism	Information communication	Before signing the agreement, the industry and education sides communicated for many times about the cooperation mode and the benefit distribution mechanism of the project output results
Cooperation agreement and cooperation entity	Reach a consensus	After many times of communication, the two sides have reached consensus on cooperation objectives, methods and mechanisms, and signed cooperation agreements and even established cooperation bases and other entities
Capital investment, sharing of experimental materials, sharing of training resources, providing internship/employment opportunities	Resource sharing	During the implementation of the project, the enterprise / school will invest funds, experimental sites, equipment, open training handouts to the project students, and provide internships and employment opportunities for the students

Table 1 Categorisation of modularisation of talent training teaching mode and explanation of its relationship connotation (continued)

Concept	*Initial category*	*Relationship connotation*
Training scheme design, course co construction, teaching material co construction, double tutor system, practice guidance, teaching evaluation, graduation design/thesis guidance, special lectures, joint research of topics, and undergraduate and master degree through courses	Academic guidance	The production and teaching sides jointly provide academic guidance to the project students by participating in the design of student training programs, setting up school enterprise courses and writing relevant teaching materials, implementing the double tutor system, setting up school enterprise joint research projects, and enterprises participating in the daily teaching evaluation, graduation thesis and design guidance of students
Project platform, practice platform, communication platform, coordination organisation	Platform Co Construction	The two sides of industry and education jointly carry out horizontal projects, build joint practice bases, hold seminars and set up coordination organisations. These platform organisations can strengthen their interaction and exchange
Internal supervision organisation and student evaluation	Internal constraints of production and education	The project establishes a supervision mechanism to form the internal constraints of production and education by means of regular evaluation of the project by the supervision team and students
Third party supervision	External constraints	The government and other third-party organisations formulate project assessment standards and exit mechanisms to form external constraints on the project
Competition results, employment and further education	Talent performance	Compare the competition results, employment and further education of students participating in the project and non-project students to assess the talent training effect of the project
The results have reached expectations, the two sides continue to cooperate and expand cooperation areas	Project performance	After a project cycle, the production and education sides will assess the completion of the expected objectives of the project and consider whether to continue the cooperation or even expand the scope of cooperation

5.2 Modularisation analysis of teaching mode of innovative talents training based on qualitative comparative analysis

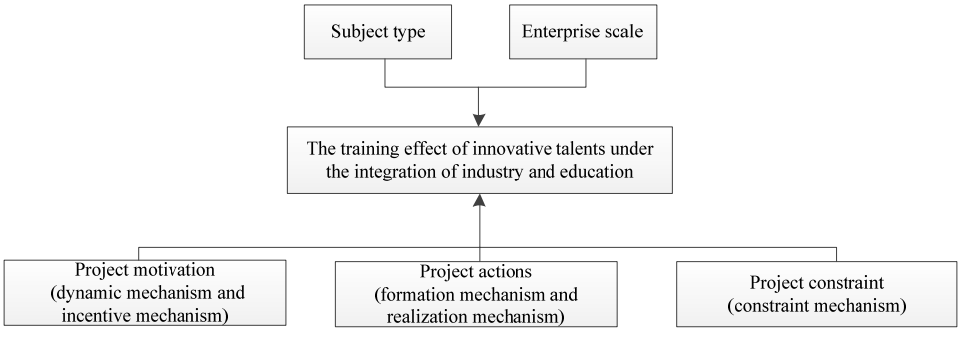
After the explanation of the modular connotation of the relationship between the categorical innovative talent training and teaching model, in order to effectively analyse the modular conditional variables of the innovative talent training and teaching model, and thus analyse the necessary conditions for the high performance of the industry education integration project, based on the above contents, the qualitative comparative

analysis method is selected to study the main reasons for the cultivation of Engineering Talents: the cultivation of engineering talents is a complex and systematic dynamic process The influencing factors such as academic guidance and practice affect each other and interact with each other. Many factors combine to jointly affect the effect of the talent training project of the industry education integration project. The qualitative comparative analysis method has its unique advantages in solving this kind of complex causality problem, that is, it can adopt an integrated approach to explore the relationship between antecedents and consequences while also considering the complexity of multiple influencing factors.

Using grounded research, this paper extracts the collaborative elements of production and education integration from the case materials, including power mechanism, incentive mechanism, realisation mechanism, constraint mechanism and feedback mechanism, and tries to analyse the connotation of each mechanism to further summarise it into project motivation, project action, project constraint and project effect, and then build a modular teaching mode of production and education integration project talent training. Through the field investigation and case analysis in the early stage, this study finds that it is far from enough to analyse the independent role or two roles of each influencing factor when analysing how to make the talent training project of the industry education integration project achieve high results. It needs to use the qualitative comparative analysis method to explore the common role of each factor from the perspective of configuration.

At the same time, in the investigation and case analysis, it is found that the strategies adopted by enterprises of different scales in the integration of production and education projects are quite different, and the enterprises of the same scale and even the same enterprise will adopt different cooperation modes to cultivate engineering talents when dealing with different disciplines (Basic or application). Therefore, based on the rooted results, this study introduces two variables, enterprise scale and discipline type, as the conditional variables for the integration of production and education to train engineering talents. Based on the existing research results and findings, this study selects enterprise scale, discipline type, project motivation, project action and project constraints as the condition variables, and the results of the production education integration project as the outcome variables. From the perspective of synergy theory, a research model including condition variables and result variables and used to analyse the operation path of industry education integration project is constructed in combination with the specific case of China's industry education integration project, as shown in Figure 1.

Figure 1 Collaborative path research model for talent training of industry education integration project



The research model of this paper includes five conditional variables, namely, enterprise scale, discipline type, project motivation, project action and project constraint, and one outcome variable – project performance. The core content of these variables and their measurement items is mainly derived from the case of integration of industry and education, and the items are modified and adjusted in combination with the relatively mature scales in the existing literature to obtain good measurement results.

5.3 Innovation of higher vocational colleges in the process of talent cultivation under the background of modularised production and education integration

On the basis of the above research and analysis, give the innovative strategy of modularisation of talent training teaching mode in higher vocational colleges under the background of production and teaching integration, so as to further improve the teaching effect of the modularisation production and teaching integration talent training mode.

5.3.1 The innovation of the modularisation of the teaching mode of talent training in higher vocational colleges under the background of integration of production and education

(1) *Firmly establish the modular concept of the talent training mode of integration of industry and education*

At present, most of the local higher vocational colleges in our country have the phenomenon that the cognition of the concept of integration of production and education is not in place and not heavy. Even if local higher vocational colleges respond to the call of the state and start to take the road of integration of production and education, there are still cases that higher vocational colleges rely heavily on teachers in the modularisation of teaching mode. The teaching requirement of the integration of industry and education is to improve the traditional teaching requirements and technical ability to the same level, rather than relying on the results of a certain aspect. This cognitive consciousness will undoubtedly affect the process of opening and promoting the modularisation of the teaching mode of the integration of production and education in higher vocational colleges.

Therefore, in the process of carrying out the integration of production and education in higher vocational colleges, we should constantly improve our own consciousness. Let students not separate from the education of the school, but also connect with the society, so that they can have social adaptability and post competitiveness, and let higher vocational colleges truly embark on the development road of integration of industry and education and modularisation of teaching mode.

(2) *Changing teachers' ideas of education and teaching*

In the process of training students, local higher vocational colleges must actively change the teachers' teaching and education concept, and create a more scientific and efficient way for the development of higher vocational colleges. The change of teachers' teaching concept in higher vocational colleges can really affect the development of students, because under the modular concept of the teaching mode of integrating production and education, the selection of teaching content and teaching need teachers to complete. In this process, teachers adopt the mode of integration of production and education and

modular teaching, which directly affects the quality of training new talents in higher vocational colleges. It can be seen that under the concept of integration of production and education, the change of teachers' teaching concept is the key to improve teaching quality and cultivate new talents. The author believes that teachers of local higher vocational colleges should mainly carry out their teaching work of cultivating high-quality talents from the following two aspects: first, teachers of higher vocational colleges should actively go deep into local enterprises, industries and other units, so as to find out the demand characteristics of these employing units for students of Higher Vocational colleges. Then, according to the characteristics of these needs, it will be directly transformed into classroom teaching content, with the aim of improving the students' adaptation to society and enterprises, and cultivating students to apply the corresponding theoretical knowledge and practical skills. Teachers should plan teaching contents in a targeted way and cultivate professional talents who are competitive and adapt to enterprises.

Second, teachers must consciously combine theory with practice in their teaching process. Although the state has always emphasised that the theoretical knowledge and content of higher vocational colleges should be "must be used" and "enough used", this does not mean that teachers can greatly reduce the content of theory, but that precise plans and supporting teaching are required. Teachers should, according to the needs of local enterprises and guided by the theory of adapting to the development trend of students' employment, change the teaching concept, integrate and simplify the important knowledge of relevant disciplines. In this way, students can have high-quality quality skills and theoretical knowledge, so as to adapt to various related jobs of students in the future employment process, avoid a single employment situation, and realise the training goal of lifelong education.

5.3.2 Innovation of talent training process in higher vocational colleges under the background of integration of production and education

(1) *Innovation in enrolment*

1 *The government provides capital investment and policy support to the joint enrolment of schools and enterprises*

The government provides financial input and policy support for joint enrolment of schools and enterprises. In the era of the great development of the market economy, we cannot just ask enterprises to assume the responsibility of social development, and only talk about dedication without asking for return. The government should vigorously support those schools and enterprises that jointly recruit students, and provide them with necessary financial support and policy protection, so that enterprises can also benefit from participation. In this way, the school enterprise joint enrolment and school running can develop better. A very optimised training mode of the school enterprise alliance is the modern apprenticeship system. In order to continue the development of the modern apprenticeship system, we must have the full support and cooperation of enterprises. The local government can grant certain subsidies and rewards to schools and enterprises that jointly recruit students and run schools according to the corresponding policies, and give corresponding rewards to enterprises according to the number of students jointly recruited by schools and enterprises. In this way, enterprises also intend to better cooperate with higher vocational colleges and complete the development and training

requirements of modern apprenticeship system, which is also an important link in the modular construction of innovative talent training teaching mode under the background of integration of industry and education.

2 *Optimise the selection of examination enrolment methods*

Since the establishment of a regional higher vocational college, its purpose is to cultivate talents who serve the requirements of regional economic development. Driven by this purpose, the enrolment issue has become particularly important. What kind of enrolment method can meet the requirements of regional development The economy of a region is not only driven by one industry, it has a variety of industries. In order to meet the different needs of multiple industries, higher vocational colleges will begin to change their enrolment methods. It is no longer a simple and single mode, but a multi demand and diversified enrolment mode. This enrolment mode provides more opportunities for candidates and also provides an inevitable factor for the development of higher vocational colleges. Higher vocational colleges in the region should be closely linked, help each other, and establish a good symbiotic enrolment model.

In terms of education authorities, when arranging the enrolment methods of higher vocational colleges, it should be considered that different enrolment systems should be established according to different types of higher vocational colleges. For example, the enrolment methods of nursing higher vocational colleges must be different from those of mechanical and auto repair higher vocational colleges. The same enrolment method cannot be applied to all higher vocational colleges. We should reasonably arrange different examination forms according to the nature of our specialties. For higher vocational colleges, more attention should be paid to the investigation of professional professional skills, and the examination difficulty of higher vocational colleges at different levels should also be changed. Especially for the national key training majors, the enrolment system should be more strict, and the degree of difficulty should be appropriately adjusted at different levels, so as to give students a sense of self seriousness and improve the enrolment rate of higher vocational colleges.

3 *Broaden the recruitment channels*

In the modular construction of teaching mode and in the higher vocational colleges jointly trained by schools and enterprises, the enrolment work needs multiple ways, types and diversified combinations. There is a huge advantage in the joint enrolment of schools and enterprises. Students can enter the joint enterprise internship during the school period. So how to give full play to this advantage requires the higher vocational colleges of schools and enterprises to change the enrolment mode and the propaganda activities after the later changes. First of all, the school and the enterprise have reached a consensus on the recruitment process and jointly recruit students. The recruitment mode of “two identities and one interview” means that the candidates have the identity of enterprise employees when they see the examination and interview and are recruited by the higher vocational colleges. This mode is very attractive to the students who want to apply for the higher vocational colleges. While studying in the school, the students also receive the education from the enterprise to the employees. When the students graduate, You can directly enter the enterprise and complete seamless learning and work. Employees of enterprises are also one of the sources of students of higher vocational colleges. Employees who fail to meet the technical and professional requirements of enterprises or

who want to obtain corresponding theoretical knowledge can enter the joint training higher vocational colleges for further study after the application is approved, so as to complete the continuous education of employees. This enrolment mode ensures the sufficient source of students of the school on the one hand and the high quality of enterprise employees on the other hand.

(2) *Innovation in education and teaching*

1 *The government, schools and enterprises build a platform to formulate the talent training plan*

The modularisation scheme of talent training teaching mode in higher vocational colleges cannot be set by schools alone, and such a training scheme lacks scientific integrity. Higher vocational colleges should work together with enterprises and the government to develop talent training programs, so as to provide excellent training programs for applicable talents jointly trained by schools and enterprises. The modular scheme of talent training teaching mode includes: training objectives, training objectives, curriculum setting, practical training, employment planning, etc. The training program jointly set up by the government, enterprises and schools can well solve the problem that the school training program is too theoretical. In the new training program, the guidance direction of the government and the demand of enterprise talents are added to create new technical talents suitable for regional economic development. The tripartite cooperation platform is committed to cultivating high-quality, high-quality and high skilled talents. Students of different majors have different training plans. Under the guidance of the government, schools and enterprises can set up courses combining theory and practice according to actual needs in the curriculum setting, so that students can truly enter social work posts and train their practical ability and competitiveness in future employment posts, So that students can master the application of skills in the study of theory.

2 *Set up courses to meet the production needs of enterprises*

The curriculum of ordinary higher vocational colleges is lack of practicality. Most of them only have theoretical accumulation and lack of real practice opportunities. The students trained in this way lack competitiveness when they enter the work posts, and cannot integrate and adapt to the practical posts that require a lot of hands-on work as soon as possible. Therefore, schools with modular teaching mode of integrating production and education should closely follow the training objectives of tripartite cooperation in curriculum setting and set corresponding practical training courses according to the development needs of enterprises. In addition, it is very difficult for students in Higher Vocational Colleges to accept pure theoretical and written knowledge. Simple theoretical learning will make students lose interest. Adding practical training to the curriculum can well mobilise students' enthusiasm, and the combination of theory and practice can play a better role. Some teachers may teach practical courses as theoretical courses due to the site of practical training in schools, but this is not the goal of curriculum setting in higher vocational colleges, and it also loses the significance of higher vocational colleges. Higher vocational colleges should combine with enterprises, fully combine the market demand after teaching theoretical knowledge, and match better professional courses according to different majors, so as to improve the practical operation level of students.

In the context of the integration of industry and education, the modular construction method of innovative talent training teaching mode studied in this paper is superior to the traditional method. This paper analyses the problems of the modular teaching mode in detail, analyses the causes of the problems, explains the connotation of the categorical teaching modular relationship, introduces the analytical method to analyse the main factors of talent training, and combines the consistency and coverage indicators, which is more in-depth than the traditional method, And on this basis, the innovative strategies of higher vocational colleges on talent training process under the background of modular integration of production and teaching are given from many aspects.

6 Case analysis

6.1 Case analysis design

In order to verify the practicability of the method constructed in this paper, the method is analysed in the form of case analysis. The overall scheme is as follows: first, the case data is obtained in the form of questionnaire survey and the case preparation is completed. Secondly, the collected case data are calibrated and the variables are assigned. Finally, the practicability of the method is studied through consistency and coverage analysis.

6.2 Case preparation

Considering that China's domestic education integration projects are in the development and exploration period, the production and education sides of most projects have not formed systematic and comprehensive project summary materials, as well as the factors such as the blocking of online research due to the epidemic situation and the uneven quality of second-hand materials, this paper adopts the method of questionnaire survey and case data as the supplement to collect data, that is, the main data are obtained through the questionnaire survey, and then the questionnaires are supplemented and screened through the mastered case data. The process of questionnaire design is as follows: firstly, based on the results of previous research, the basic framework of the questionnaire is built; At the same time, the first draft of the questionnaire is formed by referring to the content and expression of the items in the existing relevant research; Secondly, the expression problems in the first draft of the questionnaire should be carefully revised to avoid the incomprehensible sentences and unclear semantics, so that the research objects can accurately grasp the meaning of the questions in the process of filling in the questionnaire; Thirdly, members of the author's research team were invited to fill in the questionnaire as subjects. During the filling process, the author answered the questions of the subjects in time and recorded their suggestions; Then, according to the questions pointed out by the subjects, modify the contents of the questionnaire one by one, and repeat it several times until the simulated objects have no questions about the questionnaire; Finally, a questionnaire description is added to explain the purpose of this questionnaire survey to the respondents, so as to reduce the defensive psychology of the respondents and improve the questionnaire filling effect.

The questionnaire is mainly composed of two parts, including 8 items of basic information and 42 items of measurement. Among them, the basic information of the

project is mainly used to understand the basic situation of both sides of the industry education integration project, mainly to understand the enterprise scale and discipline type; The measurement item is to investigate the motivation, actions and constraints of the two parties involved in the project, and evaluate the final results of the project. For the survey items of the questionnaire, in the hope that the questionnaire can more accurately reflect the real thoughts of the respondents on the question and avoid the phenomenon of "convergence", this paper adopts the Likert four level scale, that is, the answers of the scale are divided into: very inconsistent, relatively inconsistent, relatively consistent and very consistent, which symbolises the attitude of the questionnaire respondents to the content of the question, and are respectively represented by numbers 1–4.

6.3 Data calibration and variable assignment

When qualitative comparative analysis method is adopted, data calibration refers to the process of giving set membership scores to cases, that is, the measured variables are assigned to a certain set; The key is that researchers need to judge the critical value and give corresponding reasons based on their own existing factual experience and theoretical knowledge, in combination with the research situation and the characteristics of the obtained data. Three critical values (also called anchor points) are required for the division of set membership in calibration, which are complete membership, intersection point and incomplete membership.

In addition to the data itself, the ideal data calibration also needs standards other than the reference samples, that is, it needs to exceed the relatively limited sample information. However, the research in reality is often lack of authoritative theoretical knowledge guidance when selecting calibration critical values, which needs case data to support. In the data calibration, the questionnaire data from Likert scale used in this study has its natural advantages compared with qualitative data.

However, when the number of research samples is small or the respondents' responses are biased, resulting in the distribution of the collected questionnaire data, that is, when the scale scale is inconsistent with the sample distribution, the researchers need to deal with the relationship between the two. In order to avoid the crossing value being ignored, the crossing point shall be adjusted slightly. The specific operation method is to increase or decrease 1% or 0.1% on the basis of 50%. This paper also uses the above methods to calibrate the four variables of project motivation, project action, project constraint and project effectiveness. The final specific calibration results are shown in Table 2.

Table 2 Calibration of qualitative comparative analysis data of self-taught fuzzy sets

Variable	*Fully subordinate*	*Intersection*	*Completely non subordinate*
Impetus	3.9	2.98	2.1
Measure	3.9	2.99	2.2
Restraint	4.0	2.65	1.9
Effectiveness	4.0	2.99	2.1

Data source: Calculated by Microsoft Excel software

The conditional variables enterprise size and discipline type belong to two categories of variables (variable value is 0 or 1) and need not be calibrated. Their assignment criteria are as follows:

1 judge the enterprise size according to the number of employees of the enterprise, the number of employees < 300 is small enterprises and assigned 0, and the number of employees ≥ 300 is large enterprises and assigned 1

2 judge the discipline type according to the name of the discipline or specialty filled in by the questionnaire.

The basic disciplines (including mathematics, physics, chemistry, biology, information, medicine, etc.) are assigned 0, and the applied disciplines (including machinery, civil engineering, computer science and technology, etc.) are assigned 1. Based on the data calibration and assignment standards of 5 condition variables and 1 result variable, assign the collected questionnaire data, obtain the original logical truth table, and import it into the software fsqca3.0 for the next step of analysis and calculation.

After calibrating the data, the importance of each condition variable should be analysed first. In qualitative comparative analysis, the importance of a single conditional variable is mainly judged by consistency and coverage. The calculation formula of consistency cty is as follows (X is the condition variable and Y is the result variable):

$$cty(X_i \le Y_i) = \sum(X_i, Y_i) / \sum X_i \tag{1}$$

where $cty(X_i \le Y_i)$ represents consistency, X_i represents condition variable and Y_i represents result variable.

Coverage C_g is used to measure the empirical relevance of the necessary conditions, i.e. the explanatory power of the necessary conditions to the outcome variables. Its calculation formula is as follows:

$$C_g(X_i \le Y_i) = \sum(X_i, Y_i) / \sum Y_i \tag{2}$$

where $C_g(X_i \le Y_i)$ represents coverage. The larger the value of the coverage, the greater the empirical correlation of the necessary conditions and the greater the interpretation of the outcome variables. However, as mentioned above, the conditional variables selected in this study are not the necessary conditions for the high performance of the industry education integration project, so no further coverage analysis is required.

Consistency is used to judge the necessity of condition variables (single or combined condition variables). It is to test whether the same single condition or combined condition leads to the same result from the condition.

6.4 Case result analysis

Taking the above consistency and coverage as performance indicators for case analysis, analyse the necessity of the conditional variable to achieve high performance in the production education integration project. When the consistency and coverage are higher than 0.9, it indicates that the conditional variable is necessary. If the necessity is effectively analysed, it proves that the research is practical. Take the positive and

negative values of the five conditional variables once, and the necessity analysis results are shown in Table 3.

Table 3 Necessity analysis results of single condition

Outcome variable		*The project of integration of industry and education has achieved high performance*	
Conditional variable (*~ represents "not" of logical operation*)		*Uniformity*	*Coverage*
Enterprise scale	Size	0.624166	0.603226
	~Size	0.375834	0.592632
Subject type	Discipline	0.533712	0.571071
	~Discipline	0.466288	0.635000
Project drivers	Impetus	0.766021	0.891955
	~Impetus	0.522029	0.644417
Project actions	Measure	0.771362	0.877706
	~Measure	0.520027	0.658217
Project constraints	Restraint	0.796062	0.874908
	~ Restraint	0.533044	0.702287

Data source: Calculated by fsqca3.0 software

It can be seen from Table 3 that when the production education integration project achieves high performance, the consistency of all conditional variables does not reach 0.9, among which the consistency of project constraints is the highest, reaching 0.796062, and the corresponding coverage reaches 0.874908. This value is also the highest value in the coverage, but the two highest values are also lower than 0.9. This shows that any conditional variable cannot be used as the necessary condition for achieving high performance of the industry education integration project. This method effectively analyses the necessity of variable conditions and is practical.

To sum up, none of the five conditional variables can be a necessary condition, nor can they fully explain the high performance of the industry education integration project alone. Therefore, it is necessary to analyse the combination of conditional variables, so as to find the combination of conditional variables that can reasonably explain the high performance of the production and education integration project, so as to explain how to combine the elements of production and education integration in different realistic situations to achieve a good teaching effect of innovative talents training. It can be seen that this method can provide reference for the modularisation of innovative talents training teaching mode under the background of integration of industry and education, so as to improve the teaching effect.

After the completion of the experimental analysis, the method in this paper is applied to a vocational college. The English major in this college is selected as the research object. The number of students in this English major is 407, with a total of 8 classes. The 8 classes are divided into two groups, namely, the experimental group and the control group, with 4 classes in each group. The teaching of the experimental group applies the method in this paper. The teaching of the control group uses the original teaching method of the school, and the teaching time is 90 days. After the end of the experimental

teaching, a simulated test is arranged. The content of the test is the content learned within 90 days. The average scores of eight classes are counted and the scores of the experimental group and the control group are compared and analysed to verify whether the students' academic performance has been improved after the application of the methods in this paper. The experimental results are shown in Table 4.

Table 4 Student academic performance

Class	*Student's academic performance/score*		*Score difference/point*	*Percentage of difference in scores*
	Control group	*Experience group*		
Class 1	73.4	87.5	14.1	0.19
Class 2	76.2	88.2	12.0	0.16
Class 3	75.8	86.4	10.6	0.14
Class 4	72.3	87.6	15.3	0.21

According to the data in Table 4, the students in the experimental group who applied the research method in this paper achieved higher academic performance than those in the control group who used the original teaching method. The difference between the academic performance scores of the students in Class 3 of the two groups was the smallest, which was 10.6 points, while the difference between the academic performance scores of the students in Class 4 was the highest, which reached 15.3 points, and the proportion of the difference was higher than 0.14, that is, the academic performance of the experimental group was more than 14% higher than that of the control group, It can be seen that the modular talent training method of integration of production and teaching in this paper can effectively improve students' academic performance.

7 Conclusion

This paper constructs a modular innovative talent training teaching mode under the background of integration of production and education. It explains the problems and necessity of modular construction of innovative talent training teaching mode under the background of integration of industry and education. By obtaining the initial category relationship connotation of innovative talent training teaching mode, it analyses the modular construction of innovative talent training teaching mode based on qualitative comparative analysis, and analyses the necessity result of single condition using consistency and coverage indicators to complete the construction of innovative talent training teaching mode, And give innovative strategies to achieve the innovation of talent training mode in higher vocational colleges. Through case analysis, we can see that the consistency and coverage of the five conditional variables are lower than 0.9. This study can effectively analyse the importance of conditional scalars to the modular teaching model. After the application of the modular talent training model, students' academic performance has been improved by more than 10 points, and the proportion of difference in performance has been increased by 0.14. It is practical and provides a theoretical basis for the improvement of the modular teaching model.

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