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# Exploration on Classified Talent Training of Road and Bridge Engineering in Higher Vocational Education Based on Enterprise Demand Under the “Belt and Road Initiative”

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## To cite this article:

Zhang Zhaohui, Wei Shaoyang, Li Mengjuan. Exploration on Classified Talent Training of Road and Bridge Engineering in Higher Vocational Education Based on Enterprise Demand Under the “Belt and Road Initiative”. *Science Journal of Education*. Vol. 7, No. 1, 2019, pp. 7-13. doi: 10.11648/j.sjedu.20190701.12

**Received:** December 19, 2018; **Accepted:** April 4, 2019; **Published:** April 28, 2019

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**Abstract:** In recent years, at the international level, foreign-related traffic and civil engineering enterprises have accelerated the “going out” pace under the “One Belt, One Road” national strategy. Thus, the high-quality technical talents with international vision and international engineering rules are urgently needed. On the domestic sphere, the nation has accelerated the construction of a comprehensive transportation system. Besides, enterprises are also in urgent need of a large number of high-quality technical talents in first-line construction technology, safety management, testing, and other aspects. In the aspect of vocational education reform, higher vocational colleges have accelerated the reform of classified admission examinations, and the diversification and differentiation of student sources are more obvious. In order to meet the needs of enterprises for diverse talents and to meet the needs of students to grow up and become diverse talents, the practice of classified training for two grades students and the practice of enterprises ordering training have got a great result. This paper sums up the “Two-Five-Three” classified talent training mode for Road and Bridge Engineering major, and puts forward the specific implementation methods and safeguard measures, in order to provide reference for other professional reforms.

**Keywords:** Enterprise Demand, Higher Vocational College, Classified Talent Training

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## 1. Introduction

With the diversification of talent demand and the diversification of students recruitment in higher vocational colleges, classified cultivation is an important measure for the reform of education and teaching in vocational colleges under the new background of accelerating the development of modern vocational education. Higher vocational colleges should establish the educational concept of “everyone is talented and diversified”, combine with the specific needs of enterprises for talents, innovate and practice the mode of classified talent training, according to the students' types, learning ability and career development planning, etc., and build a safeguard system that is suitable for the training of classified talents and to serve each type of student. This paper mainly takes the classified talent training of Road and Bridge Engineering major in Yangling Vocational and Technical College as an example, and summarizes the specific practices of the exploration and practice of the

professional classified talent training, in order to provide some reference for the training of other professional classified talents.

At present, as the country further increases the intensity of classified admission examinations, all provinces in China now have classified training experimental schools and research groups, especially in the field of higher vocational education. Many large-scale majors carry out talent classification training. The practice research of classification training will achieve certain results in improving the quality of teaching, meeting the individual needs of students, and improving the overall quality of students.

## 2. The Necessity of Classified Talent Training

### 2.1. The Trend of Vocational Education Reform

The Outline of the National Medium-and Long-Term

Program for Education Reform and Development (hereinafter referred to as the "Outline") stresses that the powerful driving force for the development of education is to reform and innovate and improve the dynamic educational system. The most fundamental thing is to establish the concept of everyone is talented and diversified, and to carry out the reform of the talent training system [1]. The "Outline" points out the need to establish the concept that everyone is talented and diversified, encourage personality development, diversify talents, and promote students to become talents. On June 23, 2014, the State Council convened a national vocational education work conference. President Xi Jinping made important instructions on vocational education, and emphasized: "Vocational education shoulders the important responsibility of cultivating diverse talents, inheriting technical skills, and promoting employment and entrepreneurship. Vocational education must create a good environment in which everyone can be talented and everyone can show their talents, and strive to make opportunities for everyone having a good life." He also pointed out: "Vocational education should innovate all types of vocational education models at all levels, adhere to the integration of production and education, school-enterprise cooperation, adhere to the combination of work and study, and integrate knowledge and practice to guide all sectors of society, especially enterprises, to actively support vocational education and build vocational education system with Chinese characteristics." The above important statements lead the direction for the reform and development of vocational education. Higher vocational colleges should earnestly establish the concept that "everyone is talented and diversified", and actively explore the talent training mode of school-enterprise cooperation, classification training and layered education to meet the needs of industry development and adapt to the requirement of the diversity of students' development [2-4].

## 2.2. Corporate Needs of Diversified Talents

### 2.2.1. Domestic Level

At present, China has accelerated the pace of constructing a comprehensive transportation system. The infrastructure construction of China's comprehensive transportation industry is showing a good momentum of rapid development. The pace of highway network construction is accelerating, the construction of rural roads is advancing by leaps and bounds, and the construction and development of high-speed railways and provincial and municipal rail transit are in the ascendant. Thus, enterprises urgently need a large number of high-quality technical talents good at first-line construction management, safety management and testing. The 3rd Engineering Co., Ltd of the 12th Bureau Group of China Railway, the China Construction Fifth Bureau Tunnel Company and other in-depth cooperative companies have cooperated with our institute to open the "test detection" and "safety technical management" order form classes.

### 2.2.2. International Level

In Shaanxi province, there are 7 enterprises with special

general contracting qualifications, such as the Second Highway Engineering Bureau Co., Ltd. of China Communications, the Second Highway Engineering Bureau Co., Ltd. and the 15th Engineering Bureau of China Hydropower Construction Group Co., Ltd. With the help of the national "Belt and Road Initiative" strategy, these enterprises have accelerated the pace of "going out", actively entered and continuously expanded the global international engineering market, and promoted the enterprise transformation and upgrading. In 2014, CCCC Second Highway Engineering Co., Ltd., and Sino-hydro Corporation Engineering Bureau 15 Co., Ltd. jointly set up the international engineering order classes of "traffic civil engineering" and "water conservancy and hydropower engineering" with our institute to cultivate high-quality technical talents with international vision and the knowledge of international rules.

## 2.3. Objective Requirements for Diverse Sources

In recent years, higher vocational colleges have increased the intensity of classified examinations, and the number of classified examinee has increased year by year. In 2017, the number of enrolled students in our college was 6,621, of which 3,710 were enrolled in the National College Entrance Examination (hereinafter referred to as "General Enrollment"), accounting for 56% of the total enrollment. 2,911 individual exam enrollment, accounting for 44% of the total enrollment. Among the individual exam enrollment students, 2,488 were from ordinary high school, 266 students were from three types of schools (technical school, secondary specialized school, vocational high school), 30 were enrolled in peasant education promotion classes, 40 in order classes of Qinghai Guoluo, and 87 in village and town cadres classes. The Road and Bridge Engineering major of our college enrolled 189 students in 2017, including 104 individual exam enrollment students, accounting for 55%. The knowledge bases and comprehensive abilities of various students show differences and diversity. Higher vocational education should actively adapt to the reform of the enrollment system, promote the reform of classified teaching, and implement teaching according to students' aptitudes. Only in this way can vocational education achieve the fairness and rationality, and maximize the satisfaction of students' needs for individuality and diversified development.

## 3. Educational Guiding Concept of Classified Talent Training

The guiding concept of classified talent training is "everyone is talented and diversified." which signifies that talents are diversified. As long as they love the motherland, have a sense of social responsibility, work diligently, and make a contribution to the society, they are talents. As long as the educators believe that everyone can be talented, every student can make a difference.

"Everyone is talented" means that although the talents of

people are influenced by congenital inheritance, the environment and education are the key to success. The purpose of vocational education is to serve each student to become talents. Only in the context of collective teaching, individual's personality development are taken into account and suitable education is provided for each type of student, can they gain the opportunity to become a useful talent in society.

"Diversify talents" means that vocational education should adapt to the diversified needs of economic development for social talents, the cultivation of talents must be multi-channel, multi-modal, and multi-type. It should lay a broad way for the growth of various talents, and truly realize the vocational education ideal of best use of talents [5].

#### 4. Ideas About Classified Talent Training

First of all, all the professional faculty and staff should firmly establish the educational concept of "everyone is talented and diversified" and the educational philosophy of "teaching students according to their aptitude".

Secondly, the training goal and talent specifications of diversified talent training in the Road and Bridge Engineering major should be made according to the relevant posts, and the specific needs of the enterprise order form classes, combined with the student's source type, learning ability and career development planning, etc [6-7].

Thirdly, according to the training objectives and talent specifications of the classified diversified talent training, combined with the professional standards of the posts and the first-class professional teaching standards of the college, the corresponding talent training program and the curriculum system of classified training should be made [8-10].

Fourthly, freshmen's profession education should be timely carried out to awaken students' awareness of growth and development, stimulate students' endogenous motivation, and guide students to build confidence in their learning and development, and to make the specialty selection of classified training based on their own strength and interests [11-12].

Finally, the classified teaching in the Road and Bridge Engineering major should be firmly promoted, major diagnosis and improvement should be carried out, experiences

should be timely summarized, and the working mechanism of classified talent training should be constantly improved.

### 5. Advantages of Classified Talent Training in the Road and Bridge Engineering Major

#### 5.1. Fruitful Achievement of Specialty Construction

In 2006, our college's Road and Bridge Engineering major was identified as the key construction specialty of the national model college construction project by the Ministry of Education. In 2011, it was listed as the Training base of construction major by the Ministry of Finance and the Ministry of Education, with financial support of the central government. In 2014, it was identified as one of the first "major comprehensive reform" pilot majors in Shaanxi Province. In 2016, it was listed in the key majors construction project named "Innovative Action Plan" by the Ministry of Education. All these provide experience accumulation, fund guarantee and a development platform for the exploration of classified talent training of the Road and Bridge Engineering Major.

#### 5.2. Extensive and in-Depth School-Enterprise Cooperation

Adhering to the educational concept of "employment-oriented and service-oriented", the Road and Bridge Engineering Major has established a school-enterprise partnership with more than 50 of the world's top 500 and China's top 500 transportation infrastructure construction enterprises, including China Railway Group, China Railway Construction Corporation and China Communications Construction Company, etc. relying on the school's "100 counties and thousands of enterprises" school-enterprise cooperation platform, and focusing on the "Large-scale Transportation" industry. In the past 3 years, a total of 6 enterprise-ordered classes have been established, which has created favorable conditions for the innovation of professional talent training mode and the graduate employment.

#### 5.3. Stable and Adequate Student Scale

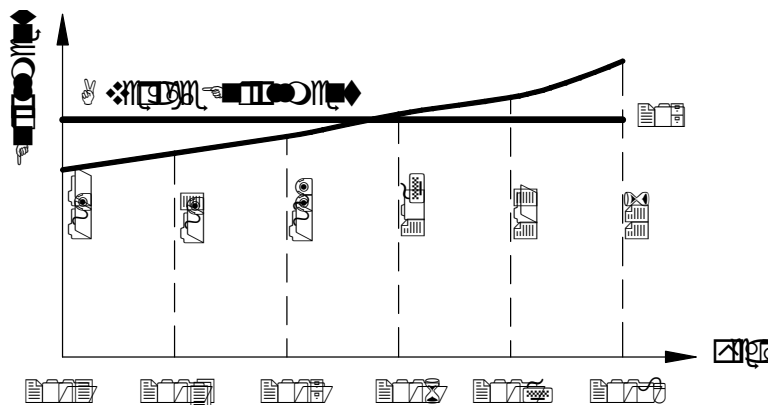


Figure 1. Average Enrollment in the past six years of the Road and Bridge Engineering Major.

The Road and Bridge Engineering major in our college was established in 2002. It has an average of 205 students enrolled in the past six years (see Figure 1). There are 586 students currently enrolled in the school. In the past three years, the first-choice registration rate has remained at 100%, and the freshmen's registration rate has reached 94%. In the past 15 years, it has cultivated more than 2,960 high-quality technical talents for the national highway transportation construction industry, making important contributions to the construction of China's comprehensive transportation system infrastructure and being widely praised by the society. Since the "13th Five-Year Plan", the transportation industry has continuously made rapid progress, and it will surely usher in a new wave of talent demand, which will vigorously promote the rapid development of the Road and Bridge Engineering major.

#### **5.4. High Quality of "Dual-Qualification Teachers"**

At present, there are 28 teachers in the teaching team of the Road and Bridge Engineering major, of which 16 have senior titles and 11 are with intermediate titles. All members have at least gotten the bachelor degree, among which, 16 are masters and 26 are "dual-qualification teachers". There are 1 national registered construction engineer and 4 second-level construction engineers in the teaching team. All teachers have first-line engineering experience. In recent years, teachers and students have completed more than 20 road transport industry-university projects, undertaken more than 30 teaching and research reform projects and scientific research projects, and published more than 160 papers.

#### **5.5. Leading Experimental and Training Conditions**

Adhering to the model of independent development and school-enterprise co-construction, the Road and Bridge Engineering major has completed the construction of the comprehensive training base under the central financial support and the construction of the training conditions for the "major comprehensive reform pilot project" in Shaanxi Province. Besides, the on-campus training base with an investment of 4 million yuan is under construction. At present, there are 3 training centers, including the existing road and bridge engineering inspection training center, and 14 related training rooms, with a total construction area of 2,850 square meters and a total value of equipment assets of over 23.6 million yuan. Our Road and Bridge Engineering major is in the leading level among the similar majors in the northwest region in the aspects like the area of training rooms, the quantity and quality of instruments and equipment, the management of training rooms, etc., providing guarantee on the experimental training conditions for the classified talent training.

#### **5.6. Rich Professional Teaching Resources**

The college has achieved full coverage of the internet on campus, and all the professional courses of the Road and Bridge Engineering major have adopted the online-offline

"three-stage" mixed teaching mode. Students can use project-based and information-based teaching resources in the mixed teaching platform, including teaching documents, engineering pictures, videos, virtual simulations, tests, discussions, homework systems, etc., to carry out "ubiquitous" independent learning mode.

## **6. Exploration and Practice of Classified Talent Training**

The Road and Bridge Engineering major of our college's exploration and implementation of the classified talent training has experienced a continuous innovation and perfection process from the simple internal classified training to the school-enterprise order form training, and from the establishment of speciality to the establishment of overseas international classes.

### **6.1. General Enrollment vs. Separated Enrollment Classified Training**

Since 2012, the enrollment ratio of classified examinations has increased year by year. The differences in knowledge foundation and comprehensive abilities of various students have brought new challenges to the traditional single education mode of higher vocational colleges. In 2013, the Road and Bridge Engineering major of our college actively adapted to the reform of the enrollment system. With the principle of "general enrollment students paying attention to professional training, separated enrollment students focusing on comprehensive quality improvement", the general enrollment and separated enrollment classified teaching mode was implemented. The training plans for general enrollment and separated enrollment students were made, and the enrollment students and separated enrollment students were classified into different classes, cultivated with the corresponding talent training plans and curriculum systems. Compared with the training plan of general enrollment students, the training plan of separated enrollment students is different in the following aspects: less total learning hours, larger proportion of the practice courses teaching hours in the total teaching hours, and larger proportion of the public courses teaching hours in the compulsory courses. Besides, in the optional courses, the comprehensive competence classes account for a relatively large proportion. Some professional basic courses have lower requirements for teaching objectives, and the curriculum implementation methods and assessment methods are relatively more flexible. The graduation requirement for total credits and certificate are relatively low. This kind of training mode with classified classes, and different standards to cultivate has achieved a good teaching effect, and has been well received by teachers, students, parents and enterprises.

### **6.2. "Two-Five-Three" Classified Talent Training Mode**

On the basis of the implementation of the pre-existing

General Enrollment and Separated Enrollment classified training, in 2014 the Road and Bridge Engineering major took the college-enterprise corporation order form classes as a platform, and established the “two-five-three” classified talent training mode: “double standards to lead, five tracks to

classify, and three orders to cultivate” through industry and enterprise research, graduate quality survey, employer visit, and combined with the enrollment system reform and the changing trend of student source structure(see Figure 2).

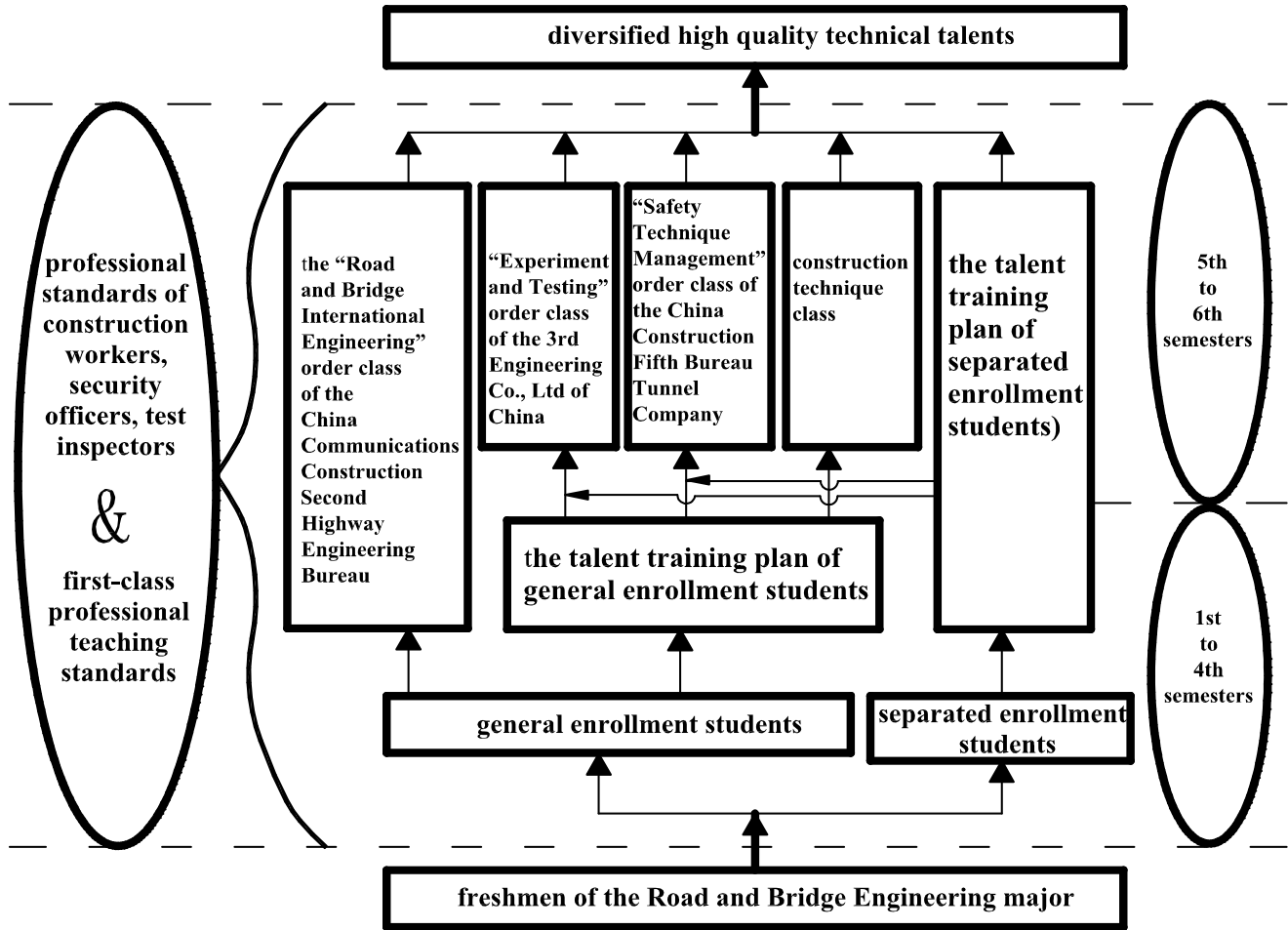


Figure 2. The Classified Talent Training Mode of the Road and Bridge Engineering Major.

The specific connotation of the “Two-Five-Three” classified training talent-mode is: “Two” refers to two standards, specifically refers to the classified talent training plan and curriculum system are made under the guidance of the professional standards of construction workers, security officers, test inspectors and the first-class professional teaching standards; “Five” refers to 5 specialties, specifically refers to students are trained classifiedly in accordance with “Road and Bridge International Engineering”, “Experiment and Testing”, “Safety Technique Management”, “General Enrollment Construction Technique” and “Separated Enrollment Construction Technique”; “Three” refers to three college-enterprise cooperation order classes, including the “Road and Bridge International Engineering” order class of the China Communications Construction Second Highway Engineering Bureau, the “Experiment and Testing” order class of the 3<sup>rd</sup> Engineering Co., Ltd of China Railway 12<sup>th</sup> Bureau Group, the “Safety Technique Management” order class of the China Construction Fifth Bureau Tunnel Company.

The implementation plan of the “Two-Five-Three” classified talent training mode of the Road and Bridge Engineering major can be operated through the following five steps.

First of all, after the entrance of the freshmen, nearly 200 students are divided into two categories according to the separated enrollment and the general enrollment to carry out enrollment education and major introduction, send out the major introduction card to inform students of the issues of classified training, and invite the order enterprise experts and professional leaders to introduce the classified training mode, providing consultation and guidance for students' classified selections.

Secondly, according to the students' enrollment of classified training and their college entrance examination scores and English scores, 35 students are selected from the general enrollment students to form the “Road and Bridge International Engineering” order class of the China Communications Construction Second Highway Engineering

Bureau. In accordance with the Road and Bridge International Engineering” order class talent training plan, the training of local talents for overseas production and management will be carried out. After graduation, these students will be employed in the overseas engineering project of the China Communications Construction Second Highway Engineering Bureau.

Third, separated enrollment students are trained according to the principle of “construction technique is the core”. Most of them join the two-way choice of campus recruitment after graduation. There are also a small number of excellent separated enrollment students who enter the “Experiment and Testing” and “Safety Technique Management” order classes in the fifth and sixth semesters to join the classified training for special positions, and then enter the corresponding enterprises after graduation.

Fourth, in the first to fourth semester, the non- “Road and Bridge International Engineering” order class general enrollment students adopt the general enrollment talent training plan to carry out the learning of compulsory courses such as public courses, professional platform courses and professional core courses. In the fifth and sixth semester, under the lead of cooperative enterprises, some of them enter the "Experiment and Testing" and "Safety Technique Management" order classes to join the classified training for special positions, and then enter the corresponding enterprises after graduation. The rest of students are trained according to the principle of “construction technique is the core” and join the two-way choice of campus recruitment after graduation.

The creation and implementation of the “Two-Five-Three” talent training mode has stimulated the enthusiasm and initiative of different types of students to learn, and promoted the formation of students' good learning habits. In addition, it has comprehensively improved the quality of the training of the professional technical talents major in Road and Bridge Engineering, enhanced the competitiveness of graduates, expanded the social impact and improved the ability of the profession’s service for the construction and development of regional economy and industry.

## **7. The Safeguards of Classified Talent Training**

### ***7.1. Enterprise Order Training Is the Platform Foundation for the Implementation of Classified Talent Training***

Enterprises not only set training objectives for cooperative order classes, but also provide teaching resources that are compatible with corporate posts standards and send experienced part-time teachers to take charge of the guidance of students' theoretical knowledge teaching and practical skills training. They also participate in the evaluation of teaching effects, and finally receive students to the internship and employment of enterprises, which lays a foundation for the continuous and effective implementation of classified talent training [13-14].

### ***7.2. Incentive Mechanism Is a Powerful Pusher for the Implementation of Classified Talent Training***

The implementation of classified talent training has increased the difficulty and complexity of teaching organizations, greatly increasing the workload of professional teachers, teaching assistants and counselors. In addition to giving appropriate favorable conditions in terms of curriculum factors and teaching workload, the college is best able to establish the project “Implementation of Classified Talent Training” according to the teaching reform project and incorporate it into the teaching reform project for management. In this way, it can not only fulfill teachers with their hard work, but also increase the sense of honor of the teachers, and the construction results can be linked with the title evaluation and teaching awards, and finally inspire the enthusiasm of teachers to promote the implementation of the classified talent training [15-16].

### ***7.3. Students’ Career Development Plan Is an Important Prerequisite for the Implementation of Classified Talent Training***

The classified talent training work should be implemented after the students enter the college. Thus, the college should inform the students in advance through the admission notice and the profession introduction card with relevant documents related to the professional classified talent training and student career development maps. In addition, the college should also provide detailed explanations for students in the introduction of majors and entrance education, and provide timely help and guidance for students' classification selections, creating a good management atmosphere for students' being diverse talents, and ensuring the accomplishment of students’ classified training [17].

### ***7.4. High Quality Resource Sharing Is the Key Support for the Implementation of Classified Talent Training***

The classified talent training will double the number of professional courses. So, it is very difficult to prepare a large number of high-quality teaching materials for classified teaching in the case of insufficient number of teachers and time. Professions engaged in the classified talent training should vigorously introduce the network training platform for enterprise employees, such as the “CSCEC Xinhe School” of the China Construction Fifth Engineering Division Corp., Ltd., and make full use of the high-quality course resources such as the National Teaching Resource Library, Zhulong Network and Civil Engineering Online Construction Network for students to learn, cultivating students' interest in learning and improving the teaching effect of classified talent training. Colleges should create a time and space environment of “study at anywhere and anytime everything”, improve the professional information teaching level to stimulate students' enthusiasm and autonomy for learning, and improve the teaching effect and teaching quality of classified talent training [18-19].

## 8. Conclusion

This paper introduces the ideas of the classified talent training, using the example of classified talent training of the Road and Bridge Engineering major of Yangling Vocational and Technical College. It mainly introduces the specific methods of the exploration and practice of classified talent training of the Road and Bridge Engineering major and puts forward the safeguards for the classified talent training in order to provide reference for various majors' classified talent training and improve the quality of vocational education talent training.

## Acknowledgements

The author gives hearty appreciation to the financial aid from the Humanities and Social Sciences Research Fund Project (GJ1836 and GJ1840) of Yangling Vocational and Technical College.

The author gives hearty appreciation to the financial aid from the 2018 Transportation Road and Bridge Engineering Vocational Education Teaching and Research Project (Major Project A, LQZZW2018102) of Road and Bridge Engineering Professional Steering Committee of National Traffic Vocational Education Teaching Steering Committee.

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