

Study on Practical Teaching Reform in Vocational Colleges under Industrial Transformation and Upgrading

Taking Nanhai District of Foshan as an Example

Nana Shang

Changzhou Vocational Institute of Mechatronic Technology
Changzhou, China 213164

Abstract—With the advent of Industry 4.0, the rapid industrial transformation and upgrading put forward new requirements for vocational colleges. Vocational education oriented to the work system must strengthen its connection with work, and practical teaching directly related to the work process must be reformed to cultivate skilled personnel needed by industry. Starting with the new requirements for talent's quality standard of industrial transformation and developments, the author analyzes the status quo and existing problems of practice teaching in vocational colleges, and puts forward countermeasures to enhance the teaching quality of practice and improve the vocational education system.

Keywords—*project teaching; virtual practice training; productive practical training*

I. INTRODUCTION

Vocational education is the education that directly serves the industry closely related to the development of regional economy. Practicality is an important feature of vocational education and practical teaching is the prerequisite that ensures the quality of talents of vocational education. The industrial transformation and upgrading put forward higher requirements on the quality of personnel, which requires that practical teaching in vocational colleges should be reformed according to the quality standards of qualified personnel with the times. Following the pace of the times, Nanhai District took the lead in adjusting industrial structure, realizing industrial transformation and upgrading, exploring a new mode of economic development in the area of Nanhai District, renewing its educational concept and implementing the reform of vocational education from scale-based development to connotation-based development in Nanhai District.

Vocational Education in Nanhai District transforms from scale-based development to connotation-based Development. Nanhai District increases investment in vocational education to build modern vocational education suitable for the development of regional industry development and strengthen the connotation construction, forming the characteristics of school-enterprise cooperation, group-run school and resource sharing of vocational education in

Nanhai district by setting up a college-enterprise co-operated vocational education group and hiring high-skilled personnel as full-time teachers. Relying on the platform of vocational education group, we should comprehensively enhance the education level of secondary vocational schools, optimize and adjust the development of vocational education, and realize the coordinated development of secondary vocational education and normal high school education. It successively become "strong county (district) of education in Guangdong Province", "advanced education area promoted by Guangdong Province" and pilot of "comprehensive education reform demonstration zone in Guangdong Province". They deepen the reform of multiple educations, integrate state-run and private educational resources, and explore effective ways of co-construction and entrusted management so as to foster brand private education groups. They promote the building of national "international education experimental zone". They should also improve teacher recruitment and performance system, activate the potential of teachers, and constantly enrich the connotation of "famous teacher project".

II. THE CURRENT SITUATION OF PRACTICAL TEACHING IN VOCATIONAL COLLEGES

The vocational colleges in Nanhai District are bold in innovation in practical training. They take the concept of intensification, ecologicalization and sustainable development as the guide to explore virtual training, project-based training and productive practice training, which highlight the type feature of vocational education, vigorously serve the development of local industries, effectively cultivate students' practical ability and create the talent bonus for vocational education.

A. *Virtual Training Highlights the Concept of Sustainable Development of Vocational Education*

Virtual training is a practical training method that uses computers to simulate real natural phenomena or social phenomena and let students to play role in simulation training. The action system centering on process logic consisting of practical situations emphasizes the implicit

knowledge that acquire self-construction, namely procedural knowledge, which generally refers to experience that can be further developed into strategy. That is acquiring the benefit of knowledge as large as possible at the lowest possible cost. [1] Virtual training can make up for the lack of objective conditions to a large extent. It uses modern information technology and teaching software to establish virtual workshops and virtual work projects, and complete the work tasks through the "virtual station" operation, which creates a emulational work environment, optimizes the teaching process, and provides students with an approximately real training environment to improve students' vocational skills. For some contents that have difficulties in achieving good teaching effect by traditional teaching methods and multimedia courseware, the use of virtual experiment demonstration method to simulate actual working environment can make students have the immersive feeling through lively and interesting teaching content and significantly improve teaching effect. For example, CNC milling machine programming process in the course "CNC milling training" can't achieve the ideal teaching results with the traditional blackboard teaching or multimedia teaching, so we establish CNC programming simulating manufacturing training room and use simulation programming software so that students can prepare their own programs according to the manufacturing process of the virtual parts under teacher's instruction and verify the correctness of the program through processing demonstration. Thus, students can complete the practical training under controlled conditions in the simulating work environment and attraction of practical training can be enhanced.

Virtual training can carry out simulation teaching starting from the aspects of collecting information, processing teaching materials, and creating situations and improve some problems in simulation teaching in implementation process. The traditional training methods are limited by the training equipment with large investment. Due to the large number of training students, it is difficult for the training teachers to solve the problems for each student, let alone observing the steps students do in actual operation. It is also difficult for students to see the concrete structure and function of the training equipment in actual practice, so the effect of enhancing students' actual perceived operational skills is not obvious. Through virtual simulation training, students can see the changes of equipment components in operation under the guidance of teachers, and understand the meaning of various parameters of equipment, perceive objects of training through vision, hearing and even feeling techniques through advanced modern information technology, so that they can deepen the understanding of the application of knowledge in the process of virtual operation, effectively exercise practical ability, and improve their knowledge and skills. In virtual training, students can give play to their own innovative spirit, try different operations, and design a variety of comprehensive training themselves. For instance, "numerical control lathe training" course uses Huazhong Century Star software, to simulate CNC lathe simulation operation in a virtual environment and complete part programming and processing. In the later stage of practical training, students are required to design and install the hydraulic control

system and electrical control system of electromechanical equipment in the virtual environment by using software and control the operation of the hydraulic cylinder by PLC. It emphasizes the comprehensive application of multi-technology including electricity, liquid, gas and PLC testing.

B. Project-based Training Can Enhance Students' Overall Quality

Project-based training is a practical teaching activity where teachers and students jointly implement a complete project under the guidance of teachers. In vocational education and training, learners are closely integrated with the work process and directly learn the knowledge system namely work knowledge that is arranged and organized according to the work process logic. [2] According to the requirements of post ability, teachers make teaching projects in the study field and put forward specific requirements. Students complete the whole process of a project in the form of group cooperation. Teachers are the guides and supervisors and mentor in the process of implementing practical training project, rather than the subject of teaching. In the project-based training process, students have great autonomy, so they can master the basic requirements and knowledge points in every aspect of the entire process through the study of specific projects and strengthen the training of multi-directional thinking when mastering the knowledge and skills, which emphasizes the coordination of knowledge, ability and quality.

Project-based training is training for students' actual ability in the process of completing specific tasks, with comprehensiveness and authenticity, providing a good environment for cultivating students' comprehensive ability. Teachers use a large number of project teaching methods and take project as driven force, to make students complete the project within the prescribed time. Teachers only guide students to cooperate with each other and jointly solve the problems encountered in the implementation of the project, to acquire procedural knowledge in practice. For example, basic mechanical design courses take the design of primary and secondary reducer as the project. Under the guidance of teachers, students should formulate their own design plans, discuss the feasibility of the project implementation plan and the rationality of the structure, design and calculate relevant engineering data, draw assembly drawings and parts drawings, indicate the technical requirements, and complete the project design. They are also required to complete the parts processing by using internship opportunities in order to test the design results. This project-oriented practice combining theoretical teaching and technical application and comprehensive using learned knowledge to complete the project tasks make students have a sense of achievement, which can improve students' enthusiasm and initiative and develop students' creative ability. In the "CNC milling training" course, teachers prepare a number of CNC milling parts for the project, and divide students into groups. Then students determine the processing program themselves, analyze the process of processing technology, make sure process parameters, prepare processing procedures, and finally complete the processing demonstration. Teachers let

the students to analyze the differences between results of different programs and find out which program is more reasonable. Then teachers introduce the teaching content by project tasks, from point to surface, and practice the entire project design process in brick-style, so as to cultivate students to grasp the machining process of workpiece and CNC programming knowledge through the project design process to achieve the entire teaching content. Throughout the activity, students actively discuss and express their opinions and teachers only guide and comment on them so as to cultivate their practical abilities and ability to comprehensively analyze problems.

C. Productive Training Cultivate Students' Professional Ability

Implementing practical training teaching in production, integrating teaching in the specific production practice, bringing industry requirements and culture into the real teaching and real production workshop can make students strengthen their understanding of profession and experience job responsibilities in the training to improve professional ability. Productive training is the practical teaching that requires students to produce products in real production tasks and equipment environment with enterprise standard. Under the joint guidance of teachers and corporate technical staff, students are the main body and assume different roles to complete the production tasks, and then carry out enterprise standardization test for the products, evaluate the production process and the results, and truly reflect the job requirements.

Productive training breaks the traditional form of separating theory and practice, effectively combines theory and practice, and integrates the theoretical teaching, practice teaching, production, and management of a course. The teaching link is relatively concentrated, and teaching places are arranged directly in the laboratory or training workshop for students to complete production tasks and to acquire knowledge and skills in the real production process. Taking CNC technology application major as an example, most of the students of this major are engaged in technical work after graduation, so they must have strong practical ability during their study in the university. Therefore, CNC application technology major rely on the school-run factory and Xiaoxiang hung large mold Co., Ltd. to form a professional construction mode of "professional + company", and launch the personnel training mode of "classroom + workshop mentoring". Students are apprentice and teachers are masters. Classroom are moved into the workshop, and the product are moved into the classroom, so that students can learn while doing and do while learning. The alternation of working and learning takes product and project as driven force to achieve the integration of teaching, learning, and working, cultivate students' professional quality, and improve students' abilities, to shorten the distance between school and business.

III. THE PROBLEMS IN PRACTICAL TEACHING AND ITS COUNTERMEASURES

The imperfect construction of training instructors team, not seamless connection between the training contents and enterprises work, and the simple evaluation of practical

teaching affect the quality of practical teaching, so practical training must be reformed according to the needs of the times and improve the teaching quality.

A. Problems of Students in Training

1) Imperfect construction of the practical training instructor team: The practical training instructor is the leading force in practical education in vocational schools, so the construction of practical training instructors directly affects the effects of students' practical training. At present, the number of practical training teachers in Nanhai District is not enough. There are fewer practical training instructors from enterprises, and the structure of dual-qualified teachers is not balanced. In the practical training instructor team in Nanhai district, there is a considerable part of teachers are not from the industry, so they lack practical experience in the enterprise, and are not familiar with equipment operation. Due to the rapid updating and replacement of training equipment for professional enterprises, the new equipment must have new operating concepts and methods. Teachers' acceptance level for different concepts and equipment of the enterprises, and the actual teaching methods are different. In addition, the main task of practical training teachers is the work of education and training, so they must follow the law of education. However, the practical training teachers from the enterprises have not received systematic education and teaching training. During the teaching process, some of the tutors turned the education into a training that only guides students in production.

2) The connection between training content and business tasks is not strong: The effective connection between training contents and enterprise work tasks is the requirement of vocational education reform as well as the guarantee of education quality, which is also the basic way to realize the zero distance between students and enterprises. Vocational schools have carried out practical training teaching, but the training content is uneven with non-uniform standard. Some training content is obsolete, which has large differences from the contents of the enterprise. In addition, training content of vocational school has poor coherence and the training content in each semester of each grade is repeated. The upgrading in level is not high, leading that students in different grades can't reflect the the increasing situation in skills. The task of the enterprise is continuous, which is a complete system. Different stages require different technology. Therefore, students' skill trained by school practice teaching is far from the job skills required by the enterprise, so it is difficult to meet the business needs of personnel.

3) Single evaluation method of practical training teaching: Practical training is the process that trains students' operational ability and improve the acquisition ability of procedural knowledge, which is different from the traditional course teaching. However, in evaluation of student training results, some schools still use the classroom

evaluation method to assess students' practical training score with the results. This single evaluation method ignores the peculiarity of practical teaching. The practical training results are only part of practical teaching while the tacit knowledge in practical training is the focus of practical training. However, tacit knowledge is difficult to be reflected in a specific result. Therefore, simply assessing the score of practical training with results deviates from the real purpose of practical training.

B. Countermeasures to Break the Problems in Practical Teaching

1) To strengthen the construction of practical guidance teachers and improve the level of practical guidance: Strengthening the construction of practical teaching instructor team is the technical guarantee that ensures the continuous improvement of students' professional skills. First of all, we should establish an incentive mechanism to promote the self-development of practical training instructor teams. The educational administration should promulgate corresponding policies and regulations according to the status quo of the practical training guidance teachers in Nanhai district to encourage teachers in vocational schools to actively practice in enterprises, get familiar with the advanced equipment and concepts of the enterprises, and enhance their own practical ability to improve the quality of double type teachers. At the same time, technical personnel and engineers with rich working experience in enterprises should also be encouraged to serve as training instructors in schools and be given policy bias in respect of wages and compilation. Second, we should strengthen the construction of training base for practical guidance teachers. The government should establish a training base for practical training guidance teachers of vocational education in Foshan with higher vocational colleges in Foshan to enhance exchanges with higher education institutions, vocational colleges and relevant training bases in Guangdong Province. They should learn from advanced experience and call excellent technical staff and engineers in enterprises and school training instructor together to accept training.

2) Increase the development of practical training content and effective integrate the tasks of enterprises: The development of training content is not only the need of vocational education training personnel, but also the production needs of enterprises. The role of experts in the process of curriculum reform is only guidance that provides vocational education courses and develops technical guidance, and the task of reform must be completed by teachers themselves. [3] To achieve the effective connection of quality of personnel cultivated by vocational schools and standards of business qualified personnel, we must follow the laws of professional training taking the real work tasks of enterprises as a carrier, decompose the work tasks of enterprises and introduce them into the learning field, and summarize and refine the professional skills required in

different learning fields, so as to carry out spiral practical teaching at different levels. We need to establish development team of practical training content in vocational school, introduce industry experts of enterprises, form a three-way linkage dialogue mechanism of school, enterprise and industry, integrate industry standards and business needs into school training content, closely connect with the production needs, effectively improve the professional and technical level of students, and shorten the distance between schools and enterprises to ensure a smooth transition from study to work for students, and achieve zero-distance employment.

3) To adjust training evaluation methods and improve the quality standard of qualified personnel: Practical training corresponds to the working process of enterprises, so the introduction of the enterprise multiple assessment way and establishment of the quality standards of qualified personnel can achieve the connection of business and school talents. Practical training evaluation group should be established composed of enterprises, industries and schools to comprehensively evaluate students' training achievements. Training evaluation should be based on the innovation of products made by students, teamwork skills, organizational and coordination ability in the work process, as well as the degree of completion of content and the excellent level of work results. Students should evaluate themselves, the team members assess each other, and evaluation team determine comprehensive evaluation, thus we can fully mobilize the autonomy and participation of students and improve students' self-reflection and self-monitoring capabilities. The training evaluation standard can be graded, such as excellent, competent, incompetent, etc., in accordance with the assessment standards of enterprises. Those who are able to finish the work tasks on time, guarantee the quality and comply with work discipline are competent; those who innovate in working methods and overfulfill tasks efficiently, or innovate in improving products and comply with discipline are excellent. In this process of enterprise assessment, students form an intuitive understanding of corporate culture and industry standards, and we cultivate students' professionalism and team spirit, so that they can truly experience the actual situation of the enterprise, which can effectively enable students to quickly integrate into the enterprise after graduation and meet the standards of enterprises.

IV. CONCLUSION

In the new era, it is the mission of the times to give priority to develop to education and cultivate talented people who are socialist-minded, professional and suitable for the development of the times. With the development of Industry 4.0, China has formulated the "Made in China 2025" strategic plan. For the vocational colleges that connect the development of the industry, how to cultivate the professional and technical personnel, management personnel and skilled personnel that are suitable for the need of the

development of the manufacturing industry is the key related to the completion of vocational education. To fulfill the mission of a new era, it is necessary for employment-oriented vocational education to highlight practical training teaching, train a teacher team with strong practical ability, strengthen the training contents connecting occupational standards, establish a sound evaluation system and enhance practical teaching quality to improve students' sense of gain.

REFERENCES

- [1] Jiang Dayuan. Structure of Discipline System and Reconstruction of Action System. *Educational Research*, 2005 (8): 53-56.
- [2] He Zhen. Construct the theoretical system of vocational education starting from working knowledge. *Education and Vocation*, 2007 (2): 5-6.
- [3] Shi Weiping. Problems in Curriculum Reform of Vocational Education in China and its Reflections. *Chinese Vocational and Technical Education*, 2006 (1): 6-8.