

# Research on the Construction of Practical Teaching System of Non-Destructive Testing Specialty in Vocational Education

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**Abstract-Practical teaching is an important part of the whole teaching system of Non-destructive Testing Specialty in Vocational education, and the cultivation of practical ability is an important part of Vocational education. This paper analyses the characteristics of practical teaching of Non-destructive Testing Specialty in Vocational education. On the basis of constructing the content system of practical teaching, it puts forward the concrete methods of implementing the practical teaching system.**

**Keywords-vocational education non-destructive testing practical teaching**

## I. INTRODUCTION

Vocational education is a preparatory education aiming at acquiring, generating and developing post needed for the knowledge, ability and quality <sup>[1]</sup>. Job orientation of post education is clear and practical. In the process of carrying out job education, we must always adhere to the needs of actual work and the post requirements. The non-destructive testing specialty is a highly practical specialty, and the practical teaching plays a decisive role in the professional teaching. The implementation of the practical teaching system of non-destructive testing specialty is the key and difficult point in the teaching reform of Vocational education. It is an important measure to lay a solid foundation for the training of skilled personnel, and an important teaching link to improve students' post competence and establish a systematic, comprehensive, efficient and applicable quality of personnel training in post education.

## II. PRACTICAL TEACHING REQUIREMENTS OF NON-DESTRUCTIVE TESTING

The Non-destructive Testing Specialty in vocational education is guided by the basic professional theory, and the teaching content is based on the principle of giving priority to practice. It focuses on strengthening the cultivation of practical ability and shortening the gap between the training of colleges and the post requirements. In the construction of the curriculum system of post vocational education, we should pay attention to the cohesion of knowledge, highlight the orientation of post,

strengthen the practicality of content, and embody the advanced nature of specialty.

## III. PRACTICAL TEACHING CHARACTERISTICS OF NON-DESTRUCTIVE TESTING

Practice teaching is an important part of training students' analytical ability, problem solving and practical ability. Compared with academic education, this link has its own characteristics and advantages in teaching objectives, contents, methods and evaluation.

### A. Post Directivity

Practical teaching of non-destructive testing in vocational education has clear aims and strong directivity. The practical teaching of vocational education must be closely related to the needs of post and closely combined with the actual situation of work and post to set up training contents and methods. In the organization of curriculum structure and teaching content, it focuses on the application and pays attention to the cultivation of students' abilities and qualities. According to the training objectives, teaching activities can be carried out directly for the post competence in order to improve the post competence of students.

### B. Teaching Practicality

Following the concept of "training practical talents in practice", focusing on the actual combat of training courses, standardization of training requirements and battlefield of training situations, systematically optimize training courses, strictly implement the norms of teaching training, improve the certification system of teachers' practical teaching qualifications, and effectively improve the pertinence, standardization and effectiveness of practical teaching.

Vocational education teaching, no matter in classroom or in practice, should embody the characteristics of teaching practice. In classroom teaching, according to the needs of practical teaching, the selection of learning content should be as close as possible to the post and create a real situation with professional post. Practice teaching should be carried out in the actual workplace, including arranging students to practice in the post and participating in the real role.

### C. Ability Comprehensiveness

Practical teaching is overall and comprehensive in training students' abilities. Practical teaching, as an important platform for training students to master non-destructive testing professional skills and improve practical operation ability, focuses on the comprehensive and coordinated development of students' knowledge, ability and quality. It not only pays attention to the training of students' non-destructive testing operational ability, methodological ability and social ability, but also pays attention to their ability to respond to new situations and new problems. Students are required not only to have qualified non-destructive testing professional accomplishment, but also to have the ideological and behavioral patterns that are compatible with social development. At the same time, students' professional emotion, professional will, professional ethics and the ability to communicate with people and team work are also trained.

### D. Applicability of Technology

As an extension of academic education, vocational education is neither a simple skill education nor a discipline-based higher education. For non-destructive testing vocational education, it is to train talents who apply engineering principles to practice and then transform them into material forms such as engineering and products, that is, technical application talents [2]. Therefore, the practical teaching system of vocational education must be an organic combination of professional technology application ability and professional skill accomplishment. The practical teaching system should be emphasized. It must be conducive to cultivating students' ability to apply technology, analyze and solve practical problems. After the trainees pass the training and examination, they can take up their posts with certificates and become a qualified flaw detector (technician).

## IV. CONSTRUCTION OF PRACTICE TEACHING CONTENT SYSTEM

Practical teaching is an important way to cultivate students' competence and the key direction of deepening teaching reform in Vocational education. Practical teaching of non-destructive testing in vocational education should take the training of technical application and practical ability and basic professional quality as the main line, and construct a practical teaching system which combines basic skills, practical training and practice.

### A. Constructing Talents Training Program

As the top-level design of training high-quality talents in Colleges and universities, talent training program is the basic basis for realizing training objectives, determining curriculum content, organizing teaching activities and implementing quality evaluation. In the formulation of personnel training program for non-destructive testing specialty, according to the principle of "post demand, ability-based, system design, highlighting characteristics", the characteristics and rules of Non-destructive Testing

Specialty in post education are explored earnestly. Following the law of vocational education, personnel training should be carried out in accordance with the idea of "improving the starting point of teaching, perfecting the professional foundation, highlighting the competence of post and giving consideration to the development of post". In the design of teaching objectives, we should adhere to the unity of post and recent development. In the teaching of professional equipment, we should take nondestructive testing as the main line, comprehensive skills training as the core, routine testing as the focus, and other testing methods as well. In the process of teaching and training, we should adhere to the combination of theory and practice, strengthen practical teaching, realize the "double certificate system" for graduates, and train them to be qualified professionals.

### B. Developing Practical Curriculum Standards

Practical curriculum standards should clearly stipulate the contents, objectives, requirements, time (class hours), teaching forms and means, teaching equipment and assessment methods of each practical teaching link, including experiments, practical training, curriculum design, skills training, internship, graduation topics, comprehensive exercises and other teaching forms. The proportion of practical training, design and comprehensive practical content should be increased appropriately in the formulation of practical curriculum standards, so that practical courses can really play the role of training students' ability to analyze and solve problems. Every practical teaching link should have a complete set of practical guidance books.

### C. Compiling Practical Textbooks

The reform of practical teaching content system in vocational education is mainly embodied in the construction of textbooks. Practical teaching textbooks are the carrier of practical teaching content and teaching methods, the basic tool of practical teaching, the basis of training technical applied talents, and the important guarantee of promoting vocational education in an all-round way, improving teaching quality and training technical applied talents. Using practical textbooks to guide students' practical training can make students' practical operation follow rules and be based on evidence. It can improve students' comprehensive application ability, design practice ability and innovation ability. It can reduce the workload of teachers' guidance and improve the teaching effect. At the same time, the compilation of textbooks should pay attention to the systematicness in theory, the advancement in technology and the practicability. The most prominent feature is the combination of theory with practice. On the basis of introducing the theory and method of nondestructive testing, the practical application of nondestructive testing technology in aviation equipment support is highlighted, which embodies distinct characteristics of technical support.

### D. Speeding up Laboratory Construction

In order to cultivate first-class non-destructive testing talents, first-class laboratories are necessary. The first-class

laboratory includes three basic elements: first-class laboratory equipment, laboratory team and laboratory management. Among them, equipment is the foundation, management is the means, and experimental teachers are the key. Laboratory construction should strengthen the construction and application of practical teaching conditions in accordance with the idea of "speeding up construction, standardizing management and highlighting application". According to the training needs of students' competence, we should constantly improve the function of practical teaching and expand research-oriented experimental projects. We should standardize management according to the requirements of teaching evaluation and promote open and independent practice teaching.

#### *E. Improving the Management System of Practical Teaching*

Practice teaching management system mainly includes three aspects: practice teaching organization management, operation management and system management. The macro-management of practical teaching is carried out at the University level, and corresponding management methods and measures are formulated. The department level is specifically responsible for the organization and implementation of practical teaching. In order to ensure the quality of practical teaching, non-destructive testing majors should formulate independent and complete personnel training programs, practical curriculum standards, practical teaching materials, practical teaching plans and assessment methods of practical teaching. At the same time, the non-destructive testing specialty should formulate a series of practical teaching management documents on practical training, practice and other aspects to ensure the smooth development of practical teaching links.

#### *F. Establishing Practice Teaching Evaluation System*

Establishing a scientific and complete evaluation system of practical teaching is the main means to attach importance to practical teaching, improve the quality of practical teaching in vocational education and strengthen macro-management. Establishing a scientific and complete student evaluation system. Improving the proportion of process assessment and perfecting the form of process assessment [3]. Strict requirements are put forward for the effect of students participating in various practical teaching links of training and internship. The assessment of students' practical ability should be strengthened, the assessment plan of practical ability should be formulated, and the content and method of assessment should be determined. In peacetime, the results can be assessed by professional instructors, and the graduation assessment should be jointly assessed by the competent department and the unit in charge of the students. According to the requirements of training objectives, it should establish a teacher evaluation system, formulate specific and clear quality standards for each link of practical teaching, and institutionalize them in the form of documents and strictly standardize their implementation. Establishing the supervisory system of practical teaching and checking the whole process of

practical teaching should not only check the completion of practical teaching, but also focus on the quality of practical teaching.

### **V. IMPLEMENTATION OF PRACTICAL TEACHING SYSTEM**

#### *A. Integration of Reason and Practice in Teaching*

Integration of theory and practice is an organic combination of basic theory learning and practical training of non-destructive testing, which fully highlights the main position of students and gives full play to their subjective initiative. The theoretical study takes the post demand as the traction, elaborates the related theory knowledge points and promotes the student's theory level. Practice teaching takes solving specific problems as its foothold, carries out research, exploration and experimental practice, deepens students' understanding and application of theory, puts theory lessons into practice in the laboratory, organically combines theory with practice, improves students' post competence, and interdependence and complementarity between theory and practice.

#### *B. "Double Certificate" System Certification*

Due to the particularity of nondestructive testing, GB9445-88 "General Principles for Technical Qualification of Nondestructive Testers" stipulates that "only nondestructive testing personnel with technical qualification certificates can engage in nondestructive testing work corresponding to the level and method of certificates they hold". Therefore, this puts forward higher requirements for colleges and universities: on the basis of improving students' comprehensive cultural quality and professional theoretical knowledge, and improving their ability to meet the needs of various posts, students' ability should also meet the requirements of the first post. On the one hand, the system perfects the validity of the equivalence between qualification certificate and diploma. On the other hand, it also strengthens the need for the first post, so that students can immediately take up their posts after graduation, thus forming their combat effectiveness.

#### *C. Content System of "Three Stages"*

Taking skill training as the main line, highlighting skills, and constructing the content system of "three stages" practical teaching, that is, according to the procedure of "basic skills professional skills practical skills", from the beginning of basic skills to the end of practical skills, skills training will run through the whole process, forming a "staged progressive, continuous line" skill training mode. The basic skills mainly include the operation skills, test skills and maintenance skills of testing instruments. Professional skills mainly include the detection skills of key components of aircraft and engine. Practical skills are mainly the ability to organize and implement non-destructive testing of aircraft and engines. Through the above training mode, the content of each lesson is full of the subject requirements of skill training, and with the progress of the course, the level of skill training is constantly improving.

#### D. Construction of "Compound" Teaching Team

Teachers' ability is an important guarantee for the implementation of non-destructive testing practice teaching. It is particularly important to build a "composite" teaching innovation team. One is to improve the knowledge structure of teachers through multiple channels, actively select teachers to study in other colleges and universities, and expand the vision of non-destructive testing technology. Second, we should take more measures to enrich teachers' experience in appointing (acting) positions. Actively create conditions and take various measures to enrich the teaching experience of faculty, such as taking on (acting) posts in equipment front-line and aviation equipment research and production factories (institutes), itinerant technical services, qualification training and teaching. Thirdly, teachers' scientific research service ability should be improved through multiple ways. Through joint research with equipment research institutes and local colleges (factories) to tackle key problems, produce equipment and solve major problems, the level of teachers' scientific research service equipment will be improved.

#### E. Guidance Model of Tutorial System

The core idea of the tutorial system teaching mode is to emphasize individual guidance in the teaching mode, attach equal importance to morality and wisdom in the teaching content, and create a harmonious, free and relaxed environment in the learning environment [1].

Vocational education students have acquired the basic knowledge and skills of non-destructive testing, and their work after graduation has been clearly defined. The tutorial system can better guide the students to find, analyze and solve problems on their own initiative according to the situation of their posts. It can also guide the students to combine their knowledge with their actual work closely, improve their ability and quality, improve their learning enthusiasm and conform to the characteristics and rules of the vocational education.

#### F. Non-Destructive Testing Skills Training

Attaching importance to the design of inspection process planning and the training of skill operation has always been the traditional teaching method of non-destructive testing specialty [4], and has achieved good teaching results. In order to meet the needs of practical teaching in Vocational education, non-destructive testing specialty has gradually established and improved internship bases inside and outside schools in recent years. In the school, a non-destructive testing laboratory has been set up to enable students to carry out various practical training in the laboratory, which fully meets the implementation of practical teaching projects stipulated in the curriculum standards and strengthens their practical ability. Outside the school, a factory-school joint practice base has been established with the repairing and overhauling factories of the units where the students work after graduation, and the comprehensive skills training courses of the students are conducted in the above units respectively. Under the

guidance of faculty and factory flaw detectors, let the students independently analyze the stress characteristics of the work, the position and direction of the defects, determine the detection method, compile the detection process, and make the correct detection results, so as to improve the students' ability to analyze and solve problems comprehensively.

#### G. Scientific Research Practice Activities

Scientific research practice refers to a series of innovative research activities carried out by trainees with the help of certain experimental equipment and related technologies on the basis of mastering certain professional knowledge [5]. In recent years, the participation of students in scientific research practice is one of the core contents of practical teaching of Non-destructive Testing Specialty in Vocational education.

Based on the actual position of the trainees and the completed scientific research projects, the trainees can think about them so that they can quickly grasp the general scientific research methods. On this basis, the trainees can combine their own scientific research experience and teach the trainees the specific methods of scientific research in combination with practical topics, so that the trainees can gradually master the scientific research methods, gradually participate in scientific research projects and improve their scientific research ability.

## VI. CONCLUSION

Practice teaching is an important part of the whole teaching system of non-destructive testing specialty and an indispensable part of vocational education. How to construct a practical teaching system and what kind of practical teaching system is directly related to the comprehensive quality of students' training, the ability of technical practice and application, the effect of innovation and cooperation spirit. The graduates of non-destructive testing specialty can improve their theoretical and practical abilities greatly through the training of perfect practical teaching, and meet the needs of the first post. The graduates do not need on-the-job training to be able to fight and win the battle.

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