

# Analysis on Laboratory Training Connotation Construction of Practical Education in University of Applied Sciences

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**Abstract**—In the current historical background of "public entrepreneurship and innovation", colleges shall cultivate the application-oriented undergraduate talents with innovative spirit through modern science education. This paper discusses the laboratory training connotation in university of applied sciences, and points out to achieve the talent training objective of universities of applied sciences by strengthening practice education reform and forming the scientific and rational management system for practical education and laboratory training as well as the feasible operation mechanism of practical education and laboratory training.

**Keywords**—university of applied sciences; practical education; laboratory training

## I. INTRODUCTION

Practical Education adheres to the educational concept of great educator Tao Xingzhi's educational concept that "Behavior is the beginning of knowledge, and knowledge completes the behavior", "Unifying teaching, learning and practicing", as well as combining learning with practicing, which is the important link in the process of teaching in universities of applied sciences, and the important means for cultivating students' practical and innovative ability. Feng Duan, a famous physicist professor also said that: "The importance of laboratory cannot be overemphasized." However, China's traditional education lays emphasis on imparting of knowledge, even the experimental teaching tends to impart more with insufficient innovation; students put too much trust in the book and lack the studying spirit. As a result, it is unrealistic to cultivate the application-oriented undergraduate talents with high quality innovation. Therefore, we shall achieve the talent training objective of universities of applied sciences through modern science education, especially by virtue of strengthening practice education reform and forming the scientific and rational management system for practical education and laboratory training as well as the feasible operation mechanism of practical education and laboratory training.

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Fund Project: Key laboratory project of embedded system applied technology of Zhengzhou (121PYFZX177), Financing scheme of "Research on Key Technology of Mobile Intelligent Terminal and Its Application" of Young Core Teachers of Colleges in Henan Province (2014GGJS-150), Key subject in Henan Province of "Communication and Information System".

## II. ANALYSIS OF LABORATORY TRAINING CONCEPT

Experiment is also called test, and it is a kind of practical activity under the condition of manual control and intervention to observe and research the nature and law of the things according to certain purpose of the people, using the necessary means, including instrument and equipment. Experiment is not only the base of scientific understanding, but also the standard to test whether the understanding is of truth, the platform to consolidate the knowledge that have been acquired and to increase new knowledge, and a form of the combination of theory and practice. Laboratory training, namely experimental teaching, is a kind of teaching form by students under the guidance of teachers, using certain equipment and materials, through controlling the operation process of conditions, to cause some changes in experimental subject and test the acquired knowledge or newly acquired knowledge through observing changes in these phenomena, and it is a form to improve students' operation ability and practical ability as well as a part of practical teaching.

## III. ANALYSIS OF CONNOTATION OF PRACTICAL EDUCATION LABORATORY TRAINING

The talent cultivation mode of universities of applied sciences is different from the cultivation of technical science-based and engineering and technology-based talents in traditional undergraduate colleges. The talent cultivation objective of universities of applied sciences shall be broadening the range of knowledge appropriately, strengthening basic theoretical knowledge teaching and the quality education in terms of humanities & social sciences and cultivating students' innovative spirit and actual working ability, namely to cultivate the field engineers with basic knowledge theory, higher overall quality, strong practical ability and adaptability as well as the ability to solve practical engineering problems. Therefore, in the process of talent cultivation in the universities of applied sciences, special attention shall be paid to the cultivation and training of students' application ability, practical ability and operation ability, and shall strengthen the application part of basic teaching contents, involve the application link into the whole teaching process, strengthen the cultivation of students'

operation ability and application ability, highlight the mutual penetration and integration of theoretical teaching and practical application and adhere to paying equal attention to engineering science education and engineering practical training. Practical education laboratory training is an important means to cultivate "high-quality, skill-based, application-oriented, and innovative" talents.

*A. A Certain Amount of Advanced Teaching Equipment, Materials and Places Shall Be Made Available as Material Basis for Laboratory Training*

Laboratory training needs to be conducted in the laboratory first of all, and the laboratory teaching instruments and equipment are the essential infrastructure in the laboratory, which are the basic means to accomplish the teaching, scientific research and production, as well as the material foundation for accelerating the modernization of experimental methods, improving teaching quality and ensuring the smooth implementation of teaching and scientific research tasks. Teaching laboratory instruments and equipment are widely used in various laboratories, such as scientific research laboratories and teaching laboratories, playing the crucial role in promoting the development of basic science and engineering experimental teaching, experimental techniques and experimental achievements of China. Experimental materials play a role of assisting or supporting the laboratory teaching instruments and equipment, which are the auxiliary supporting materials needed for giving full play to the processing equipment and process analysis or for easy operation in the process of certain experiment or analysis during experiment training. Although experimental materials are messy and even insignificant, they are the extremely part for smooth completion of laboratory training, which typically include bench clamps, special tools, hardware tools, illumination, protective equipment, welfare, health, sanitation, fire equipment, office supplies, office facilities, equipment and other supplies.

Laboratory teaching instruments and equipment as well as materials are necessary for laboratory training. In other words, laboratory training is inseparable from laboratory teaching instruments and equipment and materials. Laboratory training can be conducted directly using the scientific research laboratory or teaching laboratories, in order to share resources and avoid repeated duplication.

*B. Laboratory Training Shall Have Teaching Plans, Teaching Objectives and Teaching Contents*

Laboratory training is an organized process to achieve the transfer of knowledge, skills and ideas. Any training should have its specific goals, realization means and effect evaluation. Laboratory training shall also have syllabus, teaching plans, teaching objectives and so on. Laboratory training syllabus is the teaching guidance document for implementing the practical, innovative talent training program, and the main foundation for training guidance of selecting and compiling laboratory, training teaching of organizational laboratory, training and assessment of laboratory, and for conducting teaching quality assessment and management of laboratory training. Laboratory training syllabus shall pay attention to experiment-related basic

knowledge, requirements of basic skills and basic operations, as well as the principle of individualized teaching. Training syllabus shall meet the requirements of the times, follow the cultivation objectives of universities of applied sciences, and fully reflect the modern laboratory training teaching concept, link theory with practice, as well as determine the teaching objectives, teaching contents and arrangement of various teaching links according to the talent cultivation scheme in combination with professional features. The teaching plan of laboratory training shall combine characteristics of disciplines, meet the basic requirements of teaching progress, collaborate with theoretical course contents and be practical. Teaching purpose shall be clear with innovative content.

*C. Teachers Play a Leading Role in Laboratory Training, and Students Are the Main Body*

The teacher-leading and student-centered thought shall be implemented in the process of laboratory training and education. Make students participate in laboratory training process actively, enabling them to truly become the main body of laboratory training. In the process of laboratory, teachers shall establish the teacher-student relationship with mutual equality, mutual respect and common cooperation, and require students to actively participate in pre-class preparation, classroom teaching and training activities, after-school extended education activities. Only by enabling students to actively participate in the whole process of laboratory training and become the main body of laboratory training, can the laboratory training be transferred into innovative practical education activities.

*D. Laboratory Training Has Qualified Operating Procedures*

To protect laboratory personnel and students' safety and health during the test and to ensure the orderly conduct of the test, various safety regulations for operation shall be formulated for laboratory training process, in order to improve the safety management system of the school, strengthen security awareness of the teachers and students, protect the personal safety of teachers and students, and to ensure the laboratory training work is conducted in a civilized, safe and orderly manner.

*E. Laboratory Training Is a Process of Observation, Analysis and Research*

Laboratory training is based on experiment, and the experiment is the primary method of scientific inquiry. Its function cannot be replaced by other teaching methods. It is not only the important means for acquiring knowledge and knowledge innovation, but also plays the unique role in cultivating students' ability of acquiring knowledge and improving students' scientific literacy, which is conducive to the promotion of students' scientific thinking, revealing the essence of various phenomena of nature, being a way of learning and the learning content and objective.

Laboratory training plays the important role in problem exploration, the formation of knowledge, cultivation of intellectual quality and non-intellectual quality. We can discover problems, solve the problems through experiment, and then form the knowledge. Observation is the first step no

matter from the vivid intuition to abstract thinking or from abstract thinking to the active practice. Over 90% of the information received by human from the outside world is obtained through observation. Develop students' ability to observe through laboratory training, so that students can get the comprehensive and correct perceptual knowledge, and then form the knowledge after obtaining right conclusions through analysis and synthesis. The cultivation of students' observation ability is closely related to cultivation of students' imagination, memory, thinking ability and self-learning ability and they supplement each other, for example, ask students to focus their attention to observe the matter and its changes comprehensively and carefully, so as to obtain rich emotional material, and it is possible to guide students to think abstractly, thus to form a scientific concept and theory. Moreover, the more careful the observation, the more problems they can discover and ask. They can think and inquiry more with the learning autonomy and inquiry being reflected fully.

#### *F. People-Centered Education Philosophy Is Implemented for Laboratory Training*

People-centered education philosophy is the essential requirement for education development, but also the reflection of scientific outlook on development. People-centered education philosophy requires education shall focus on meeting people's need; education shall center on promoting people's comprehensive development; education should focus on the development of human personality; education should be based on promoting sustainable human development<sup>1</sup>.

Strengthening laboratory training is not just to strengthen the practical education laboratory training or experimental teaching, but also shall implement the education philosophy of people-oriented and individualized teaching, to create favorable conditions for innovative talents to stand out, and create the new cultivation mode of integrating theory and practice, linking curricular and extracurricular, connecting learning and application, as well as organic integration of professional knowledge ability acquisition and human's development in society, which is the internal demand and important implementation model for cultivating innovative talents.

#### *G. The Key to Laboratory Training Is Management*

With the instruments and equipment's modernization level continues to improve, instruments and equipment cover more and more categories of science and technology. To manage, use and safeguard the instruments and equipment, more scientific and technological knowledge are required to be grasped, which is the objective requirements proposed by modern instruments and equipment for laboratory technicians. Laboratory staff's political and ideological as well as professional level, service awareness and working efficiency will directly affect the construction of laboratory, the improvement of laboratory training quality, as well as the process of scientific research.

College and various Departments should conduct the re-education and training for laboratory team in a planned, purposeful, step by step way, to train them in terms of experimental skills through participating training class and exchange learning in related colleges. All kinds of laboratory technicians shall learn about the experimental skills they need to master and take initiative to participate in training, for example, the proper use of instruments, especially the proper use and maintenance of large scale precision instruments, preparation of reagent reagents, as well as a variety of experimental procedures, etc., to make the laboratory technicians know the experimental training equipment by heart, and be clear about the content and process of the experimental content set up in the laboratory, and be familiar with the operation specification, to develop a stable laboratory technician team with solid basic knowledge, wide knowledge, professional support and technical expertise.

Practical education laboratory training is a comprehensive system construction project. The procurement of training equipment and the establishment of laboratory just possess the basic condition for practical education laboratory training. In order to truly give play to the role of experiment equipment and laboratory in practical education laboratory training, we shall pay attention to the key factor of its connotation management. Improve the teaching quality of practical education laboratory training through the connotation construction of practical education laboratory training. The realization of the general objective of application-oriented talents is the important research subject of the higher education in universities of applied sciences.

#### *H. The Fundamental Purpose of Laboratory Training Is to Train Students' Exploration Ability, Comprehensive Ability, Innovation Consciousness and Ability*

Innovation ability is an important part of human quality, but also an important condition for survival. This ability is indispensable for any one of us no matter what profession we are engaged in. It is a state of mind, a kind of personality feature and a kind of comprehensive quality. Innovation is the soul of a nation's progress, and the inexhaustible driving force, important foundation and guarantee for national prosperity, and it is the vitality and hope of a county and nation. The formation of students' abilities is a gradual process, which is formed gradually in the process of continuous accumulation of knowledge as well as the in the conscious and planned cultivation process. Ability without knowledge is of low-level, yet the knowledge lack of capacity has difficulties in innovating and transforming the objective world. Therefore, experimental teachers shall pay more attention to systematically cultivate and train students' comprehensive application ability while imparting knowledge, namely to cultivate students' exploration ability, comprehensive ability, innovation consciousness and ability.

#### IV. CONCLUSION

In 2015, General Office of State Council issued "Opinions on Deepening the Implementation of Innovation and Entrepreneurship Education Reform of Colleges," which gives the clear objective for innovation and entrepreneurship

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<sup>1</sup>Zhou Yujuan. Study on educational concept of "people-oriented" [J]. Culture and Education Materials, 2012 (22):109-110

education of colleges for the next five years, requiring deepening innovation and entrepreneurship education reform of colleges comprehensively. College students are valuable human resources, college students' innovation and entrepreneurship is the important strength for public innovation and entrepreneurship. Higher Education Act also clearly states that "The fundamental task of higher education is to cultivate the senior specialized talents with innovative spirit and practical ability." Universities of applied sciences take the cultivation of applied talents as the training objective. Practical education should adhere to integrating theory with practice, strengthen the training for students' practical skills, to consolidate the professional teaching achievements, comprehensively improve students' professional application ability and overall quality, and establish the practical education laboratory training system with school characteristics, in order to adapt to the demand for talents by social and economic development in the 21st century.

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