

Research on the Correlation between CMA Certification Laboratory and the Cultivation of Applied Practical Talents in Universities

Guiqin Xu

Department of Safety Engineering
China University of Labor Relations
Beijing, China

Abstract—In recent years, more and more analytical testing center of universities has passed laboratory qualification certification. The feasibility and necessity of the qualification testing of our testing laboratory are analyzed by analyzing the cases of testing laboratory with qualifications of other universities in China and the status quo and existing problems of our testing laboratory. There are many advantages through the qualification of the testing laboratory, such as, the positive impact on the cultivation of undergraduates' practical ability, the improvement of the practical ability of the teaching staff, the promotion of the scientific research ability of the teachers, and the standardization of the laboratory management level and so on. Four specific measures for the CMA-certified testing laboratory to promote practical teaching are listed. The results show that the CMA-certified testing laboratory can greatly promote the teaching and research and management level of universities.

Keywords—CMA; laboratory qualification certification; testing; practical ability

The investment in experimental equipment in universities is increasing, which makes the teaching equipment level of universities greatly improved, the scope of testing is increased, the accuracy of testing is higher, and the means of testing are more advanced. many universities are also actively participating in the qualification certification of laboratories in order to improve the utilization efficiency of experimental equipment and to make universities more closely related to social practice.

I. SIGNIFICANCE OF LABORATORY ACCREDITATION IN UNIVERSITIES

A. *The meaning of Measurement Certification*

CMA is the abbreviation of China Metrology Accreditation that is based on the Regulations for the Implementation of the Measurement Law of the People's Republic of China issued in 1987 which refers to this assessment as "measurement certification". Specifically, the CMA is based on the "Measures Law of the People's Republic of China", and the metrological administrative department of the people's government at or above the provincial level (currently refers to the former AQSIQ and the quality supervision bureau of the province, autonomous region, or municipality directly under the Central

Government). A comprehensive certification and evaluation of competence and reliability that means this type of certification is for all product quality supervision and inspection agencies and other types of laboratories that issue notarized data to the society, such as various product quality supervision and inspection stations, environmental inspection stations, and disease prevention and control centers.

The laboratory qualification evaluation carried out by the university are all promoting the construction and development of the teaching laboratory by using the qualification certification system standards, the examination and approval of the laboratory and the testing organization. As far as the university itself is concerned, more and more teachers are fully aware of the reliability and effectiveness of the test data issued by accredited laboratories so that they are willing to choose such laboratories to provide testing activities for their own research in research activities.

In July 2006, the National Certification and Accreditation Administration formulated a new "Guidelines for Accreditation of Laboratory and Inspection Institutions" in light of the new international standards and the requirements of China's legal system management. During this period, university laboratories began to accept measurement certification, accreditation review and laboratory qualification assessment. The Analytical Testing Center is a gathering place for high-end instruments and scientific research talents in universities and is also the first laboratory to provide services to the society. A total of 34 analytical testing centers passed the review to obtain the qualifications for providing testing services to the society. Through the review, not only the analytical testing center receives the administrative license of the service society, but also greatly improves the laboratory management level and personnel quality in the evaluation. The accreditation criteria for laboratory are gradually being accepted by universities and become a guide to improve the management level of laboratories. In August 2015, the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China promulgated the Measures for the Administration of Qualifications of Inspection and Testing Institutions and the Guidelines for the Evaluation of Qualifications of Inspection and Testing Institutions. In January 2016, it officially replaced the "Standards for Accreditation of Laboratory and Inspection Institutions" which

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reflects the increasing emphasis on the management of third-party testing services by the state.

B. Current Situation and Analysis of Qualification Recognition of University Laboratories in China

The qualifications of Chinese university laboratories are first started from the analysis and testing centers of some key universities of subordinate colleges and universities. After more than 20 years of development, dozens of key laboratories have obtained the qualifications for measurement certification. Meanwhile, a reliable quality assurance system has been established in such laboratories and the operational and management work levels have been improved. While providing training and testing services for teaching and scientific research, these qualification accreditation laboratories are also the first to provide services to the society, especially in the areas of non-standard testing, comprehensive testing and unknown exploration which are unmatched by other social testing organizations.

II. NECESSITY AND FEASIBILITY OF CMA CERTIFICATION IN OUR LABORATORY

Many of the instruments in testing laboratory of our university are advanced in comparison to the low utilization of the instrument.

A. Conducive to the Standardization of Laboratory Management

The evaluation criteria for testing institutions are not only the standards for administrative examination and approval, but also the only standard for accredited laboratory accreditation in China. The regulations for university laboratories to pay attention to qualification certification are not only qualified for providing external testing but also the review criteria which can provide the best reference for laboratory development. It is also the development direction of laboratory management standardization and the content that college laboratories which must follow. At present, the proportion of experimental teaching in the whole teaching system is increasing. Whether it is talent training or innovative experimental teaching demonstration center and other national construction projects, practical teaching is one of the innovation highlights. In addition, the establishment of various types of experimental sites such as university experimental teaching demonstration centers, training centers, simulation laboratories, etc., requires effective management mode to ensure their normal operation and orderly development. The qualification of inspection and testing institutions has a standardized quality management system which has guiding significance for the establishment of a scientific management system in university laboratories.

It is found that 85.7% of the management system is related according to the review criteria refined by the "Laboratory Accreditation Assessment Criteria" and the evaluation criteria of the university-based teaching laboratory. The organizational structure and program control in the evaluation criteria management system and document management are essential in laboratory management practices. The lack of reference model for management has always been a short-board for the

standardized management of all university laboratories so that the evaluation criteria are naturally the best blueprint for perfecting such laboratory management systems. In the process of norm-setting, we must face up to a series of differences arising from the different purposes of the service society and service teaching, selectively use the content of the evaluation criteria as a reference for the management system, take the teaching needs as the starting point, take into account the characteristics of the laboratory, and formulate the teaching type. The laboratory management system draws on the content of technical standards to improve the level of experimental teaching management in a reasonable and orderly manner after the conditions are mature.

B. Promote the Improvement of the Overall Quality of Laboratory Management Personnel

The laboratory has limited staffing and limited channels for promotion in our university. In this case, the management level and management level of the laboratory need to be improved. Through the implementation of CMA certification, the relevant experimental personnel have specific requirements from laboratory management, experimental project operation, number of experimental personnel, etc., then the laboratory certified safety engineering department will certainly have a group of teachers to participate which is conducive to the integration of the entire experimental staff.

C. Application of Laboratory accreditation to the Cultivation of Undergraduates' Practical Teaching Ability

The laboratory accreditation criteria not only play an important role in optimizing laboratory management but also have an important impact on the reform of teaching content and the cultivation of students' practical ability. Students entering the laboratory not only verify and deepen their professional knowledge but also the laboratory culture is part of the professional composition, for example, laboratory procedures, operational practices, safety regulations, use and management of consumables, documentation, etc. The university is the gathering place and dissemination place of culture and the testing and testing institution certification standard is regarded as the laboratory management culture advocated by the society. The school incorporates it into the knowledge structure of talent cultivation and through the training and training into self-discipline behavior habits, develops good morality that respects the law, strictly abides by the norms, and follows the norms.

The teaching level is the guarantee of high-quality talents. The improvement of teaching level requires three elements that are teachers, tutorials and teaching environment which are closely related to the laboratory. A science and engineering teacher who does not have excellent experimental quality is unlikely to be a good mentor. Experimental ability is also an important indicator for evaluating teaching ability. It is impossible to cultivate high-quality students through words and deeds if teachers do not have the concept of standardized management and do not master the basic ability to use system management behavior and program quality control. Whether the teaching content is perfect determines the level of knowledge and quality of talents and imparting students' professional knowledge is an aspect of teaching content from

the basic criteria that experimenters should understand the work norms that inspection procedures should follow to the integrity records that rely on program content. To achieve the traceability of the value which is the basis that students must master to understand the rules and strictly abide by the norms. Only in this way can the cultivated talents' knowledge structure be in line with social needs and be accepted by all inspection and testing institutions in society. A student who is fully trained strictly in a laboratory that is in accordance with the standardized procedures is more likely to be welcomed by the employer than a student who has no laboratory training which shows that the talent development environment is extremely important.

D. Application of Laboratory Certification to the Construction of Laboratory Talent Team and the Cultivation of Teachers' Scientific Research Ability

Scientific research achievements are important indicators to measure University level. Scientific research can't be separated from data, laboratory support and standardized management system. The evaluation criteria for inspection and testing institutions are a set of operation management systems which not only stipulate the hardware conditions of laboratory instruments and equipment but also have very specific requirements for laboratory operation criteria, organizational structure, management criteria, staffing and file management contained in the laboratory management system. Several management elements realize the whole process control of inspection and inspection work and their quantitative traceability normative thinking ensures the authenticity and credibility of inspection data. Whether the scientific research results can be recognized depends on whether the experimental data provided are true and reliable, and whether the results obtained can be repeatedly verified. If the laboratory testing management system is implemented according to the standards of certification and accreditation, its results will naturally have high credibility and persuasion. University laboratories have become an important platform for research and development of various technologies. In recent years, the activities of laboratory qualification assessment and evaluation of experimental teaching demonstration center carried out by universities are to promote the construction and development of teaching laboratories by using the ideas of qualification recognition and evaluation system standards, laboratory and testing institutions' examination and approval. As far as the university itself is concerned, more and more teachers are fully aware of the reliability and validity of the testing data provided by the accredited laboratories. They are willing to choose such laboratories to provide testing activities for their own research.

Laboratories of university are important places for cultivating students' innovative ability and practical ability which requires that experimental engineers and technicians must have rich professional theoretical knowledge and broad knowledge to solve the problems and sudden problems raised by students during the experiment. The scientific research topics of universities are generally in contact with the international frontiers. The scientific research samples obtained by the research team must have the ability to test the samples without the national standard or other testing methods, and

ensure that they are verified which requires laboratory technicians to continuously learn forward-looking knowledge and improve their ability to innovate. According to the requirements of the laboratory qualification assessment criteria, detailed internal and external training plans are formulated each year, and the continuing education training of all experimental engineering and technical personnel is organized to continuously improve the comprehensive testing ability of teachers. Combined with the 13th Five-Year Development Plan of our university, the requirements for improving scientific research capabilities and enhancing the core competitiveness of the school, the testing laboratory certification is conducive to teachers' use of laboratory experimental conditions to publish high-level papers. Society is not only the best way for university laboratories to have recognized social status, but also to train high-quality talents to return to society. To the end, through the opening of the laboratory to understand the needs of society, and open a window of communication with the society in order to guide the reform of teaching content and improve the quality of teaching, cultivate talents that meet the needs of society.

III. SPECIFIC MEASURES FOR THE IDENTIFICATION OF TESTING LABORATORY QUALIFICATIONS FOR PRACTICAL TEACHING

A. Laboratory Qualification Management System for the Practical Teaching Content of Undergraduates

The CMA certified laboratory need to comply with the "Laboratory Qualification Accreditation and Assessment Criteria" and "Inspection Institutions Qualification Accreditation and Assessment Criteria". It also obtains the certificate of certification of qualification of the inspection institution and engages in third-party inspection within the scope of authorized inspection. The Department of Safety Engineering, especially the orientation of occupational health, occupational hazard detection is a very important aspect according to the specialty setting and school-running orientation. It is a new attempt to combine the qualification identification management system with the qualification identification authorization project and the practical teaching of safety engineering specialty, and it is also beneficial for students to integrate the theoretical knowledge they have learned. Laboratory qualification certification management system is mainly embodied in system documents which generally have four layers of structure including quality manual, procedure document, operation guide and record. The quality manual mainly includes all the requirements of "the Criteria for Accreditation and Assessment of Laboratory Qualifications" and "the Criteria for Accreditation and Assessment of Inspection Institutions", and clarifies the quality policy and quality objectives according to the actual situation of each laboratory. Operational instructions involve specific inspection items and management documents for standardized operation of instruments and equipment. Through these contents in undergraduate practical teaching, students can have a comprehensive understanding of the management of qualification confirmation laboratory and lay a foundation for future management system work or scientific research and use of instruments.

B. The Laboratory Qualification Certification Project is Used for the Specific Practical Teaching Content of Undergraduates

In the actual teaching process, the students conduct experiments in accordance with the requirements of the CMA certification laboratory including the standard management of samples, the processing of samples and the specification filling, signing and review of inspection records. In addition, students can also carry out some innovative experiments on inspection projects outside the classroom, simulate some authentic inspection and testing work, from the selection of inspection items and the inspection basis to the implementation of the inspection process so that the final inspection report. The writing is done in full accordance with the specifications of the inspection station adding practical experience to the students. If a student graduates into some inspection institution or department and there will be a standardized concept in his mind who works according to the requirements of standardization can quickly adapt to the job and can play a professional advantage that can achieve the goal of undergraduate practical teaching.

C. Designing a comprehensive open experiment in the testing experiment

Comprehensive design of open experimental factors is incorporated in the testing experiment relying on the existing laboratory instrument conditions. Students are required to incorporate experimental scenarios into the experimental design of each experimental project, design experimental conditions and request data analysis and error analysis of the experimental results. The purpose is to guide students to feel the scientific atmosphere early and to improve their ability to analyze and solve problems, cultivate comprehensive experimental literacy and stimulate creative thinking.

D. CMA certification laboratory as a student practice base

During the CMA certification process, a large number of system management and experimental hands-on work can attract excellent and willing undergraduates to participate in the process and specific operations of the certification work. This work process featured with a lot of work and involves many

factors. On one hand, it is a useful supplement for the staff for the laboratory; on the other hand, it is a rare opportunity for all-round exercise practice for the students. Therefore, the certification also attracted a number of students from the two levels of occupational health to join the process. It can also be combined with social projects to attract more students to join this practice session if the CMA certification is able to operate normally in the future which is a deliberate supplement to our practice base.

IV. CONCLUSION

Laboratory accreditation promotes the cultivation of college students, the improvement of the teaching staff, the improvement of laboratory utilization, the sharing of resources and the strengthening of the links between universities and society. Therefore, the certification of university testing laboratories should be promoted as soon as possible.

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