

Study on the Construction Strategy of Teaching Quality Evaluation System of Experimental Courses based on Engineering Education Accreditation

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Abstract

Teaching quality is the lifeline of school development, and a scientific teaching quality evaluation system is the basis for improving teaching quality in colleges and universities. With the rapid promotion of engineering education professional certification, teaching quality monitoring mechanism and graduation requirement achievement evaluation mechanism are getting more and more attention from schools. By analyzing the causes of the problems and learning from the experience, the paper puts forward the experimental course teaching quality evaluation in terms of adhering to the concept of experimental course teaching quality evaluation based on engineering education professional certification, improving the experimental course teaching quality evaluation mechanism, optimizing the evaluation index system, strengthening the responsibility of evaluation subjects and making reasonable use of the evaluation results, etc. The strategy of constructing experimental course teaching quality evaluation system is proposed and explained through case study.

Keywords

Engineering Education; Professional Accreditation; Experimental Courses; Teaching Quality Evaluation; Accreditation Concept.

1. Background and Significance of Research

Along with the rapid development of economy and society and the continuous expansion of higher education scale, China's higher education has stepped into the era of quality as the theme, and the state has issued several relevant documents one after another, such as the Notice on Launching the Audit and Evaluation of Undergraduate Teaching Work of Ordinary Higher Education Institutions issued by the Ministry of Education in 2013, the Guidance Opinions on Launching Quality Improvement Action issued by the State Council of the CPC Central Committee in 2017, the In 2018, the National Conference on Undergraduate Education issued the Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensively Improving the Capacity of Talent Cultivation, and in 2019, the Ministry of Education issued the Opinions on Deepening the Teaching Reform of Undergraduate Education and Comprehensively Improving the Quality of Talent Cultivation, which guide and regulate the improvement of undergraduate teaching quality from the national level. Engineering education is an important part of China's higher education and "one of the three parts" in the higher education system. Under the background of education globalization, China has also accelerated the process of internationalization of engineering education. Engineering education professional accreditation is an internationally accepted quality assurance system for engineering education and an important basis for the international mutual recognition of

engineering education and engineer qualifications, the core of which is to confirm that graduates of engineering majors meet the established quality standards recognized by the industry, and is a kind of qualification evaluation oriented to the cultivation objectives and graduation export requirements.

In practice, it provides guidance for colleges and universities to build the teaching quality evaluation system of experimental courses according to their own characteristics, promotes the development of teaching quality evaluation practice, forms a good atmosphere of "attaching importance to teaching, reassuring teaching, researching teaching and improving teaching", and promotes the improvement of teaching quality.

2. Current Situation and Analysis of Domestic and Foreign Research

Teaching quality is the lifeline of school development, and scientific teaching quality evaluation system is the basis for improving teaching quality in colleges and universities. Scholars at home and abroad have made a lot of researches in teaching quality evaluation and achieved corresponding research results.

2.1. Current Situation of Foreign Research

"(1) Research on the basic concept of teaching quality evaluation based on engineering education professional accreditation individuality, and secondly, the need to focus on student learning. Amy Driscoll theoretically analyzed the value of student-centered teaching quality evaluation in universities and verified the importance of evaluating teachers' teaching quality under the guidance of student-centered concept in practice. Michael Harris and Roxanne Cullen argue that a learner-centered (i.e., student-centered) teacher teaching environment can effectively promote teachers' awareness of students' subjectivity and adjust their own roles in teaching, while more importantly, it can enable students to recognize their roles in teaching, understand the meaning of learning William Barone argues that there are various models of "student-centered" teaching and learning, and that it is important for students to face up to their own learning and take responsibility for their own learning. At the same time, Professor William Barone's empirical summary of the "principles of student-centered psychology" suggests various principles, including the nature and goals of the learning process, the construction of knowledge, and the factors that influence students.

Froyd, J., and Simpson, N., using the University of Maryland as a study, identified the implementation of a "student-centered" pedagogical model as the key to significant educational outcomes. To test whether teachers, programs, professions, and schools are student-centered, Bulmberg, P. designed self-evaluation indicators that cover five dimensions: the function of content, the role of the teacher, the responsibility for learning, the process of assessment, and the balance of goals and power. In his view, the transition from traditional teaching to "student-centeredness" is a long process. Therefore, according to this view, he designed the indicators in four levels: (1) teacher-centered; (2) low level of transition to student-centered; (3) high level of transition to student-centered; and (4) student-centered [13]. He argues that student-centered teaching quality evaluation consists of four main aspects: first, defining the student-centered concept; second, evaluating student-centered teaching conditions; third, evaluating student-centered teaching design and implementation processes; and fourth, setting and evaluating student-centered teaching objectives.

(2) Current status of Outcome-based education (OBE) theory and practice research

The OBE education model (Outcomes-Based Education), first appeared in the basic education reform in the United States and Australia [15,16]. The Western Australian education sector defines OBE as "an educational process based on the achievement of certain learning outputs for students, where the educational structure and curriculum are the means rather than the

end. If they do not contribute to the development of specific student competencies, they are rebuilt and student outputs are the drivers of the functioning of the education system". Subsequently, the OBE concept was adopted by ABET, the American accreditation system for engineering education, which requires engineering education majors to analyze learning outcomes for the creation of core courses, and the concept has been successful in safeguarding the quality of engineering education courses. Tucker S.E. believes that OBE is similar to OFE (Outcomes Focused Education) in that they are both driven by student Kiruthika Ragupath, through a comprehensive analysis of OBE research, proposed the main elements of OBE education system and its four basic principles: clear focus on student learning outcomes, reverse design, rational evaluation and continuous improvement, and expanded opportunities.

(3) Status of research on teaching quality evaluation system of colleges and universities

Teaching quality evaluation is to evaluate the teaching results as a whole or in a special way according to the teaching quality standard system, to dig out the problems and to make suggestions for rectification, focusing on the analysis and characterization of teaching results. Teaching quality evaluation system of colleges and universities is a part of teaching quality assurance system. In western education system, teaching quality assurance of colleges and universities consists of internal and external aspects, among which, external assurance mainly refers to the guidance, supervision and evaluation of teaching activities of colleges and universities by the specialized agencies of national nature or regional nature, education departments, etc. using education policies and regulations.

2.2. Status of Domestic Research

Research on the basic concept of teaching quality evaluation based on engineering education professional accreditation "student-centered" theory and practice research status Compared with foreign education research, China has been prevalent in the "teacher-teaching model", which takes the knowledge of teaching materials as the core and teachers teach the knowledge in teaching materials in the classroom. The teacher teaches the knowledge in the textbook in the classroom, i.e., the traditional "tri-center" (meaning textbook-centered, teacher-centered, and classroom-centered). It was not until the 1990s that the concept of "student-centered" education began to attract the attention and attention of the domestic education sector, and less research has been conducted on it in the field of higher education. According to Liu Xianjun, the concept of "student-centered" education is not simply to shift the focus of teaching to students' learning effectiveness, ignore teachers' teaching ability and teaching methods, and pay no attention to teaching materials, but to focus teachers' teaching ability and teaching methods as well as the curriculum knowledge system with reference to teaching materials on students' learning effectiveness, to change students' learning attitudes, stimulate students' learning interests, and make engineering education more in line with social development trend and social needs through teaching evaluation and continuous improvement, while laying the foundation for deep education research in terms of theory.

2.3. Literature Review Analysis

Through the research of related literature at home and abroad, foreign universities' teaching quality evaluation on the basis of engineering education accreditation and its foundation has formed a more perfect theoretical system and application framework. Although teaching quality evaluation of colleges and universities in China has a long history, due to the short implementation time of engineering education professional certification in China, most colleges and universities do not have a more in-depth understanding of its standards and regulations, so the research and related practice of college teaching evaluation system based on the concept of engineering education professional certification are still in the exploration stage, and the experience to be learned from is insufficient, and there are mainly deficiencies in the following aspects.

(1) There is a certain deviation between the professional certification of engineering education and other professional assessment and certification in China, i.e. engineering education certification focuses on achieving standards rather than optimization.

(2) When applying the concept of engineering education professional certification for the construction of corresponding mechanism, the basic structure is only roughly constructed, that is, the so-called in-depth optimization reform is carried out in a certain aspect, resulting in incomplete infrastructure and forming a "building in the air".

(3) deviations in understanding the concept of engineering education, such as constructing "evaluation of learning" mechanism in teaching and evaluation of teaching activities under the concept of "student-centered", and completely abandoning the traditional "evaluation of teaching" Fourthly, the basic framework of the evaluation system of teaching quality of experimental courses is not perfect, and there are problems such as unclear responsible persons, imperfect evaluation methods and unclear evaluation of continuous improvement of teaching process.

3. Definition of Related Concepts

3.1. Engineering Education Professional Certification

The term "accreditation" is commonly used in Western higher education assessment and quality assurance literature, and is usually defined as an association-based, voluntary method and approach to quality assurance and improvement that began in the early 20th century, and is a direct self-management activity within the academic and professional education community, mainly carried out by non-governmental organizations. It is a direct self-regulatory activity within the academic and professional education community, mainly carried out by non-governmental institutions, professions, and associations of professionals in specific fields, etc. Through accreditation, recognition is given to colleges and universities or professions that meet or exceed established educational quality standards, and institutions and professions are assisted in further improving the quality of education.

Professional accreditation is an important part of the higher education evaluation system. In contrast to institutional accreditation, which is a comprehensive certification of the quality of education of colleges and universities as a whole, professional accreditation is a specialized accreditation of professional education colleges and professional education programs by specialized accreditation bodies, carried out by specialized professional associations together with experts from colleges and universities and industry experts in the field of the profession, in order to provide quality assurance for the entry of their personnel into the specialized professions. It provides quality assurance of the preparatory education of the personnel to work in the specialized professions.

3.2. Experimental Course Teaching Quality Evaluation Mechanism

Experimental course teaching quality evaluation mechanism is an important part of the experimental course teaching quality evaluation system, which is an important guarantee for the smooth implementation of experimental course teaching quality evaluation organization, implementation, information collection and processing, result summary and feedback. Teaching quality International Organization for Standardization (ISO) defines quality as "the sum of characteristics and features that reflect the ability of a product or service to meet explicit or implicit needs". "Quality, by its very nature, is a property of an objective thing that has a certain "capability" to satisfy a variety of needs due to its "capability". If we consider each factor of the specification structure of talent cultivation as information, we can also consider teaching quality as a complex of information with specific contents, i.e. the information complex of the society's demand for talents and the degree of adaptation of higher education institutions to

the society's demand, including the complex of information on the ideological quality, professional knowledge and vocational skills level, physical quality and psychological quality of talents.

3.3. Curriculum Evaluation

The theory of curriculum evaluation is of great importance in the history of modern pedagogy, and its rise is marked by the publication of the American educator Taylor's monograph "The Preparation of Achievement Tests", which is also called "the father of contemporary educational evaluation". In his book "Fundamentals of Curriculum and Instruction", Ralph Taylor defined the concept of evaluation as "a process of determining the degree of behavior change that actually occurs". According to Taylor's definition, "curriculum evaluation refers to an activity of making value judgments and seeking ways of improvement on issues related to the planning, implementation, and results of the curriculum by systematically collecting relevant information and using various qualitative and quantitative methods based on certain evaluation criteria." The curriculum evaluation proposed by Taylor is a model of curriculum evaluation that focuses on whether educational goals are achieved by using various ways to assess changes in students' behavior.

3.4. Mechanisms

The word "mechanism" is of Greek origin and refers to the construction and working of a machine. This original meaning of mechanism can be interpreted in two ways: first, what the machine consists of and why it consists of these parts; and second, how the machine works and why it works in this way. In sociology, it refers to the structural relationship between the elements and the way of operation, and its connotation can be expressed as "the specific way of operation that coordinates the relationship between the parts to better function under the premise of facing the existence of each part of the thing".

4. Experimental Course Teaching Quality Evaluation Mechanism

To sum up, the quality evaluation mechanism of experimental course teaching is to establish a reasonable structured evaluation institution and to carry out the quality evaluation of experimental course teaching in an orderly manner under the premise of perfect system construction. It is an important part of the experimental course teaching quality evaluation system, which clarifies the process, specification and responsibility of the evaluation, and is the guarantee of the experimental course teaching quality evaluation.

4.1. Formative Assessment

Formative assessment (FA) was first proposed by American scholar Michael Scriven in 1967, which refers to the teaching process in which teachers evaluate learning effects in order to understand students' learning, and give feedback to students on the results in time or make targeted teaching adjustments to promote students' learning. There are three key words in this description: during the teaching process, feedback to students and adjustment of teaching, and promotion of student learning. The purpose of traditional teaching evaluation is to detect the effect of student learning and give grades accordingly, i.e., student learning performance determination. Therefore, traditional university teaching evaluation mainly consists of midterm and final exams with grades given, and does not include the three characteristics of formative evaluation. It is defined here as conclusive evaluation, which is fundamentally different from formative evaluation. If teachers analyze and summarize the problems reflected by conclusive evaluation in a timely manner, propose corresponding measures and apply them to the improvement and adjustment of teaching in laboratory courses, then conclusive evaluation also has the nature of formative evaluation. It can be seen that the core idea of

formative evaluation is to promote students' learning through the evaluation of teaching quality of experimental courses, which is a revolution in the field of university teaching evaluation, changing the traditional understanding of teaching evaluation and reflecting the concept of "continuous improvement" of engineering education professional certification.

4.2. Deming Circle Theory

PDCA cycle, also known as Deming's loop, was proposed by Dr. Deming, an American quality management expert, as a scientific procedure to be followed for total quality management. D (design) according to known information, design specific methods, programs and layout, and then according to the design and layout, specific operations to achieve the contents of the plan; C (check) that is, to summarize the results of the implementation of the plan, to distinguish what is right and what is wrong, to clarify the effect, to identify problems; A (act) that is, the results of the inspection of processing, the success of the experience A (act) that is, the results of the inspection processing, the success of the experience to affirm, and to be standardized, the failure of the lessons should also be summarized, to draw attention to the solution measures; for the problems not solved, submitted to the next PDCA cycle to solve. Therefore, the PDCA cycle does not end with the end of a round of operation, but is a continuous rolling up cycle, the end of the previous cycle means the beginning of the next cycle. Moreover, the PDCA cycle is not a cycle that stays at the same level; every cycle solves part of the problems and achieves corresponding results, driving the quality to rise continuously. the PDCA cycle theory is more widely used in higher education teaching quality monitoring, talent training mode, etc. Schools should apply the PDCA cycle model to the teaching quality monitoring mechanism, and form the teaching quality management into Continuous rising cycle to achieve the purpose of improving teaching quality in colleges and universities Analysis on the formation and development of teaching quality evaluation system of experimental courses.

5. Formation and Development of Teaching Quality Evaluation System of Experimental Courses

In 1984, firstly, Beijing Normal University formulated the evaluation method for teachers' teaching quality and put forward the simple measurement standard, then in 1985, Nanjing Normal University tried out the teaching evaluation system and started the evaluation for teachers' classroom teaching quality, which strongly improved the teaching quality. In 1985, the central government issued the Decision of the Central Committee of the Communist Party of China on the Reform of Education System, which decided to evaluate the quality of teaching in colleges and universities and to implement a system of rewarding excellence and punishing poor performance. In the same year, the State Education Commission published the Notice on the Research and Pilot Work of Evaluation of Higher Engineering Education, which comprehensively deployed and implemented the pilot evaluation and research for higher engineering education. After entering the 21st century, the theory and system of evaluating the teaching quality of experimental courses in colleges and universities became more and more mature, and the Ministry of Education issued "Some Opinions on Further Strengthening Undergraduate Teaching Work in Higher Education Institutions" in 2005 (Teaching High [2005] No. 1), which further emphasized that professors and associate professors should give classes to undergraduates as a basic system and included in teachers' teaching assessment. So far, it can be seen that since the formation of China's experimental course teaching quality evaluation, its evaluation objects are all teacher-centered, evaluating teachers' teaching level, teaching attitude, teaching ability, etc., without giving much consideration to students' learning quality. With the progress of society and the deepening of the research on the evaluation of teaching quality of experimental courses, the evaluation of students' learning effectiveness has gradually entered the line of sight of the evaluation of teaching quality of experimental courses.

6. Development of Teaching Quality Evaluation of Experimental Courses Since the Professional Certification of Engineering Education

The core of the Washington Agreement is to confirm that graduates of engineering majors meet the established quality standards recognized by the industry, to certify based on the classification of large professional fields, to respect the basis of their respective educational reality, to respect the autonomy of professional schooling, and not to interfere with specific professional settings. Although there is a unified minimum certification requirement, it is limited to the principle requirements of common curriculum and faculty. Each school should combine the needs of the region's economic development and scientific and technological progress, and have different focus and diversified professional content in the professional settings to run their own characteristics. Since 2013, the number of applications and acceptance of engineering education professional accreditation has increased significantly, especially with the implementation of "Double Million Plan", engineering education professional accreditation has been paid much attention by professionals. Accordingly, the control of certification standards has become more and more strict. According to the data, after 2013, the overall ratio of accepted majors to applied majors is about 1/2, and the ratio of officially approved majors is even smaller, which is due to the fact that some majors do not understand the concept, standards and implementation of engineering education professional certification very deeply, and there are many problems. Since the implementation of engineering education professional certification, its general standards have been revised several times. Through the study of relevant markings and documents, we found that the development of engineering education professional certification in teaching quality and continuous improvement is mainly divided into three stages, which have experienced a gradual and in-depth and detailed process.

7. Problems and Analysis of Classroom Teaching Quality Evaluation System

Through the summary and analysis of the development history of teaching quality of experimental courses, it can be seen that the formation of output-oriented evaluation of teaching quality of experimental courses in China is relatively short, and there are many problems in the construction and implementation process of the mechanism. Therefore, in this paper, we have reviewed the documents related to the teaching and evaluation of experimental courses in many schools, combined with literature research and questionnaire survey, and summarized and analyzed the problems of teaching and evaluation system of experimental courses in colleges and universities.

7.1. Insufficient Understanding of Concept Leads to Imperfect Evaluation Mechanism

Although the professional certification of engineering education in China has developed rapidly in recent years and the number of applied majors has increased rapidly year by year, the number of engineering majors that have passed the certification is less than 10% of the total number of engineering majors up to now, and a large proportion of majors and teachers are not familiar with "output-oriented", "student-centered" and "continuous improvement". A large proportion of majors and teachers lack sufficient understanding and awareness of the concepts of "output-oriented", "student-centered" and "continuous improvement", and have not established a perfect output-oriented mechanism for evaluating the teaching quality of experimental courses. Teachers are the core role in the design, implementation and evaluation of laboratory course teaching, and their understanding and mastery of the accreditation concept is the key factor in the establishment of output-oriented laboratory course teaching and evaluation mechanism.

The teachers' understanding of the accreditation standard and the accreditation concept and whether they think the profession has established the quality evaluation mechanism of output-oriented experimental course teaching were investigated by questionnaires. The results show that as the main designers, implementers and evaluators of experimental course teaching, more than 50% of the teachers' understanding of the accreditation standard and concept of engineering education is at the level of basic understanding, and they are not able to understand and implement it deeply, and nearly 40% of the Teachers think that the profession has not clearly established or only basically established the quality evaluation mechanism of experimental course teaching, which indicates that the current understanding of theoretical knowledge related to engineering education professional accreditation in Chinese universities is not deep enough, which will inevitably have a negative impact on the teaching of experimental courses based on result-oriented. Through the research of relevant system documents of many schools and combined with the questionnaire survey, it is found that the main problem of experimental course teaching quality evaluation system at present lies in the lack of perfect evaluation mechanism, or although the experimental course teaching quality evaluation mechanism is embedded in the graduation requirement reaching evaluation mechanism, but the evaluation data of experimental course teaching quality and the reasonableness evaluation of the results are left to the course group or the teacher in charge of the course, without Set up a special institution or responsible person to review the system, content, method, and reasonableness of the evaluation data of the teaching quality of experimental courses.

The lack of in-depth understanding of the accreditation concept by the instructors seriously affects the results of the output-oriented experimental course teaching quality evaluation. The current experimental course syllabus, assessment content, evaluation of the reasonableness of the evaluation results responsible for teachers and subject groups, resulting in the lack of unified guidance, clear quality requirements and the necessary supervision and management of the experimental course teaching and evaluation process, making the lack of consistency and continuity of the experimental course teaching quality evaluation standards, poor evaluation results, insufficient to support the achievement of the corresponding graduation requirements index points. The main reasons for the formation of such problems are: first, the influence of inertia thinking formed by traditional teaching evaluation concepts and methods, the degree and willingness of majors and teachers to change to teaching quality evaluation under the new concept is not strong; second, the study, propaganda and interpretation of the accreditation concept are not enough, and the guidance for the establishment of evaluation mechanism and teaching evaluation of experimental courses is insufficient.

7.2. The Evaluation Index System Focusing on Students' Learning Effectiveness Needs to be Improved

The output-oriented course quality evaluation is the core of quality control and the basis for graduation requirement achievement evaluation. At present, the evaluation of the teaching quality of experimental courses does not fully focus on the achievement of course objectives and its support for the corresponding graduation requirement index points. Through the questionnaire survey of professional teachers and students, the results show that 21% of teachers and 51% of students think that the course assessment evaluation cannot fully cover the teaching objectives, 48% of teachers and 54% of students think that the course assessment can basically correlate with the students' ability requirements specified by the teaching objectives of the experimental courses, while 61% of students think that the teaching quality evaluation of the experimental courses they participate in is for teachers. The results of the survey show that both students and faculty believe that the assessment of the quality of laboratory course teaching is based on the teacher's "teaching" rather than the students'

"learning". From the survey results, it can be seen that both students and teachers do not reflect the teaching quality evaluation of experimental courses very well, and students' feelings about teaching evaluation are obviously worse than teachers' feelings, which also reflects the lack of student-centered and result-oriented guidance in the setting of teaching quality evaluation index system of experimental courses.

7.3. Teachers' and Students' Awareness of Responsibility of Evaluation Subjects is not Clear

The subjects of experimental course teaching quality evaluation include teachers, peers, school and college-level teaching supervisors and students, etc. However, as the most critical implementers and recipients of experimental course teaching, the evaluation subject awareness and role of teachers and students are not obvious. Students are the target group of teaching, the most direct audience, and their participation in the process of evaluating the quality of experimental courses and the importance of the evaluation results directly affect the authenticity and objectivity of teaching quality evaluation. In recent years, with the change of teaching philosophy and the promotion of engineering education accreditation, students gradually participate in the process of teaching quality evaluation, but there are many problems with this participation. The prerequisite for students to be able to evaluate the teaching quality of experimental courses is that they are very clear about the professional graduation requirements, learning outputs and their supporting relationship with course objectives. Through the questionnaire survey, from the majors that have participated in engineering education professional accreditation, 50% of the teachers think that students need to be trained and guided to participate in teaching quality evaluation, 8% of the teachers think that students cannot participate in teaching quality evaluation as evaluation subjects, and nearly 45% of the students also have not been trained in detail before conducting teaching quality evaluation. It indicates that the current situation of students' evaluation of teaching and learning in colleges and universities is that students do not know much about the professional training objectives, graduation requirements, course objectives and the supporting relationships among them, and they are also ignorant of the competence requirements they need to achieve through course learning. On the other hand, 63% of the students in the research feedback that their participation in the evaluation of teaching quality of laboratory courses is a step they must go through before they can check their grades in the university academic affairs system, so it can be imagined that their attitude toward the evaluation of teaching quality of laboratory courses and the credibility of the evaluation results are very unsatisfactory.

7.4. A Single Evaluation Method Cannot Reflect the Comprehensive and Reasonable Evaluation

Considering the requirements of accreditation standards as well as the authenticity, comprehensiveness and rationality of evaluation, the evaluation of teaching quality of experimental courses should be carried out in multiple channels and ways, combining qualitative and quantitative analysis. Through the research on teachers and students, it is found that the evaluation methods of teaching quality of laboratory courses are still mainly based on classroom performance, regular assignments and final examinations, and the nature of course reports and phase tests are the same as those mentioned above, although there are also student talks and questionnaires, but their proportion is very small, and according to the previous survey, the content design of these two evaluation methods is still open to question. For the above-mentioned evaluation methods mainly based on final examinations, the evaluation results are mainly based on the calculation of scores, and the data sources of their evaluation are mainly based on the final examinations (generally accounting for 70%-80% of the assessment weight), supplemented by the usual performance (generally including homework, classroom interaction, etc., accounting for 20%-30% of the assessment weight), which leads

teachers and students to pay too much attention to the final examinations; the talk method and the questionnaire method in experimental courses. The interview method and the questionnaire method have received low attention in the evaluation of teaching quality, and their content design is less involved in learning effectiveness and the rationality of evaluation is doubtful, so they only play a reference role in the evaluation. This leads to a lack of multidimensional data for reference and a failure to analyze the evaluation results comprehensively, which is not comprehensive and sufficient for the evaluation of students' comprehensive ability and does not truly reflect the support of the evaluation results for the achievement of course objectives. Through the questionnaire survey, nearly half of the teachers and students think that the quality evaluation mode and proportional distribution are not reasonable, which also shows from the side that teachers and students are increasingly disagreeing with the assessment mode with result evaluation as the main purpose, and there is an urgent need to form a result-oriented teaching quality assessment and evaluation mode based on experimental courses.

8. Composition of Teaching Quality Evaluation System of Experimental Courses based on Engineering Education Professional Certification

The complete experimental course teaching quality evaluation system is the core of teaching quality monitoring mechanism and graduation requirement achievement evaluation mechanism, which can provide reasonable and effective basic evaluation data, and its composition should include responsible organization, system guarantee, evaluation process, evaluation subject, evaluation index system and other parts. In the process of implementation, the three major concepts of "student-centered", "result-oriented" and "continuous improvement" of engineering education professional certification should be integrated, reasonable evaluation methods should be selected, evaluation results should be reasonably used and corresponding continuous improvement measures should be proposed to promote the improvement of teaching quality of experimental courses. It should be especially noted here that the responsible institution must set up a course quality evaluation basis and result rationality review institution composed of experts and teachers who are familiar with the teaching work of the major, responsible for reviewing the experimental course syllabus, evaluation methods and contents, and the rationality of evaluation results to ensure that the whole experimental course teaching quality evaluation is designed, implemented and evaluated on the basis of student-centered and result-oriented. The evaluation is designed, implemented and evaluated on a student-centered and result-oriented basis. A variety of evaluation methods are used to evaluate the teaching quality of experimental courses in a comprehensive and reasonable way. The learning effectiveness of students is multifaceted, and a single evaluation method is simple to operate and easy to implement, but its evaluation of students' learning effectiveness is more one-sided and cannot evaluate the teaching quality of experimental courses in a comprehensive, comprehensive and reasonable way.

In the context of engineering education, more attention should be paid to the evaluation of students' ability of comprehensive application of knowledge and their ability to solve practical engineering problems. The teaching quality questionnaire of experimental courses is reasonably designed to increase the evaluation of students' ability acquisition. It is changed from teacher and teaching process evaluation to student ability acquisition evaluation, and open evaluation content is appropriately increased to contribute to teaching activities from students' perspective. In addition, with the introduction of new teaching methods, students can speak, discuss and evaluate the classroom teaching situation, learning feelings and knowledge acquisition in real time through the pop-ups in multimedia teaching. Teachers can analyze and

summarize the information in the pop-ups through the evaluation mining method to dig out effective information, so as to achieve the evaluation of teaching quality.

Strengthen formative evaluation, focus on random and real-time evaluation in the teaching process, implement process evaluation, make evaluation "live", establish a comprehensive evaluation method combining formative evaluation and result evaluation, gradually reduce the proportion of result evaluation, increase the proportion of formative evaluation, and disperse the assessment of most of the experimental course teaching contents to the whole teaching process. To the whole teaching process, improve the credibility and efficiency of the evaluation of students' learning effectiveness, and reduce the errors brought by a single evaluation method.

9. Reasonable Use of Evaluation Results to Propose Continuous Improvement Measures

Reasonable analysis and use of evaluation results, emphasis on evaluation feedback and continuous improvement of the curriculum. The purpose of classroom teaching quality evaluation is to timely understand the achievement of course objectives, students' mastery of relevant knowledge, the acquisition of corresponding abilities and problems in the teaching process, etc., so as to provide a basis for optimizing the teaching design of experimental courses in the next cycle, strengthening students' abilities and improving teaching quality and course objectives achievement, instead of evaluating just for the sake of evaluation. The evaluation subject should take the initiative to feedback the evaluation results to the teachers and relevant majors in time, so that the teaching implementers can grasp the teaching effect and students' learning effectiveness in time. Finally, a virtuous cycle of continuous improvement of teaching is formed to continuously improve teachers' teaching ability and students' learning effectiveness.

10. Conclusion

Student-centered and output-oriented teaching quality evaluation system of experimental courses is the "last kilometer" to realize real engineering education professional certification in China. This paper discusses the connotation of "student-centered", "result-oriented" and "continuous improvement" concepts of engineering education professional accreditation, and explores the problems in the evaluation concept, system construction, responsibility consciousness of evaluation subjects and reasonable application of evaluation results in the evaluation of teaching quality of university experimental courses by means of literature research, questionnaire survey and case analysis, etc. The problems existed in the evaluation concept, system construction, awareness of responsibility of evaluation subjects and reasonable application of evaluation results. The reasons for the problems were analyzed, and the strategies for constructing the evaluation system of teaching quality of experimental courses were proposed in terms of adhering to the concept of evaluation of teaching quality of experimental courses based on the professional certification of engineering education, improving the evaluation mechanism of teaching quality of experimental courses, optimizing the evaluation index system, strengthening the responsibility of evaluation subjects, and reasonably using the evaluation results.

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