

Course Reform of General Chemistry Based on Evaluation of Curriculum Achievement under Engineering Education Accreditation

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Abstract. The Engineering Education Accreditation Standard emphasizes a student-centered, educational approach that focuses on student learning outcomes and continuous improvement in teaching quality. The evaluation of the achievement of the professional curriculum objectives is the main means and basis for assessing (certification) graduation requirements, and provides a basis for the continuous improvement of teachers and teaching administrators in the future. This article combines the general chemistry course of Xijing College as an example to introduce and analyze the evaluation method of the achievement of the professional basic course objectives, and also to explain the shortcomings and continuous improvement and improvement.

I Introduction

The Washington Accord is an international mutual recognition agreement for undergraduate professional certification in engineering education. It was initiated in 1989 by engineering professionals from the United States, the United Kingdom, Canada, Ireland, Australia, and New Zealand to ensure the quality of engineering education through engineering professional undergraduate certification. Lay the foundation for mutual recognition of engineers' qualifications. On June 2, 2016, China Association for Science and Technology represented China as a full member of the Washington Agreement. Joining the "Washington Accord" is an important measure to promote the training of Chinese engineers in accordance with international standards and improve the quality of engineering and technical personnel training. It is of great significance to the cultivation of talents in engineering technology in China^[1-5].

Engineering education certification is a special certification for the implementation of engineering majors in colleges and universities. It is also an internationalized background for engineering education quality assurance. It is an international recognition of engineering education and engineer qualifications. Its purpose is to test the quality of engineering education for certification majors, and Whether the graduate's ability meets the equivalent requirements for the international undergraduate engineering degree mutual recognition^[6-8].

The three concepts of engineering education certification are Outcome Based Education (OBE), student-centered and continuous improvement. Output-oriented education, also known as Learning Outcome Based Education, refers to the goal of instructional design and instructional implementation that students achieve through the educational process. The core of output orientation in engineering education is the training objectives and graduation requirements. Graduation requirements are a detailed description of the knowledge and abilities that students should master when they graduate, including the skills, knowledge, and abilities that students acquire through their majors^[9].

"General Chemistry" is one of the core subjects and core courses of civil engineering. Through the study of "General Chemistry", students will be able to use the basic principles and thinking methods of chemistry to understand and describe the various fields of modern science, technology and engineering. This phenomenon, even providing a strong insight into our understanding of the behavior of atoms and molecules, is also a necessary condition for deep understanding of the frontiers of civil engineering disciplines.

II Course Objective Setting

The civil engineering major involves three graduation requirements for the "General Chemistry" course. There is an indicator point corresponding to the "General Chemistry" course under each graduation requirement. At the time of the development of the syllabus, three course objectives are set up, and each course objective supports one indicator point. According to the training program of the civil engineering profession, a weight value (achievement target value) is set for each indicator point. As shown in Table 1:

Table 1 Correspondence matrix of course goal & graduation requirement indicator point

Graduation requirements of Civil Engineering Professional	Indicator point of Graduation requirements	Weights	Course objectives of General Chemistry
Graduation requirement 1 Engineering Knowledge Ability to apply mathematics, natural sciences, civil engineering foundations and expertise to solve complex engineering problems in civil engineering.	Indicator Point 1.1 can use the basic concepts of mathematics and natural science to express complex engineering problems in civil engineering.	0.15	Course Objective 1: Master the basic theories and experimental techniques of modern chemistry, understand the framework of chemistry disciplines; observe material changes and phenomena from a chemical point of view in engineering techniques, and analyze problems with practical problems involving some chemical-related engineering techniques. .problem solving skill.
Graduation Requirements 4 Research can apply scientific principles and adopt scientific methods to study the complex engineering problems of civil engineering majors, including designing, implementing corresponding experiments, collecting, analyzing, processing and interpreting experimental data, and obtaining reasonable and effective information through information synthesis. Conclusion and guide engineering practice.	Indicator Point 4.1 can apply the basic principles of civil engineering science to the complex engineering problems of civil engineering majors and design experimental schemes by scientific methods, correctly operate and use experimental devices, complete experiments and collect reliable test data.	0.18	Course Objective 2: According to the chemical reaction and experimental scheme, the chemical experiment equipment can be selected or built, the experimental system can be constructed and the experiment can be carried out; the scientific method and thinking of the collection, collation, analysis and interpretation of the experimental phenomena can be learned.
Graduation Requirements 4 Environment and Sustainability The ability to understand and evaluate the impact of the complex engineering issues of civil engineering on environmental and social sustainability.	Indicator Point 7.1 Can understand and understand the concept and connotation of ecology, environmental protection and sustainable development.	0.08	Course Objective 3: It can evaluate complex engineering problems according to the principles of environmental and social sustainable development; it can use theories, viewpoints and methods of chemistry to examine social hot topics such as environmental pollution, energy crisis, and emerging engineering materials.

III Course Evaluation Methods

The course assessment is divided into two parts: the average score and the final grade. The grades are divided into attendance, after-school assignments and classroom performance. The final exam types are divided into multiple-choice questions, fill-in-the-blank questions, noun explanations, short answer questions, quiz questions and calculation questions. 6 parts. The corresponding scores for attendance, after-school assignments, and classroom performance settings correspond to course objectives 1 through 3. Course objectives 1 through 3 correspond to indicator points 1-1, 4-1, and 7-1. The final exam corresponds to the course objectives 1-3 according to the knowledge points contained in the title, and the course objectives 1-3 correspond to the index points 1-1, 4-1, 7-1. The usual score setting is 30 points, and the final exam setting score is 70 points.

IV Courses Reached Evaluation Results

For the 2016-2017 school year, the 2015 civil engineering students take the course performance analysis method as an example. The teaching effect of the course can be feedback through the level of student achievement^[10].

Taking Indicator Point 1.1 as an example, the score of all the assessment items is 39 points, and the average assessment score is 31.974. It can be seen that the evaluation value of "General Chemistry" for index point 1.1 is $31.974/39=0.820$, which is calculated for each of the three indicators. The results are shown in Table 2:

Table 2 Course goal achievement degree calculation

	Average score of assessment items	Total score of assessment items	Course goal achievement degree calculation
Indicator Point 1-1	31.974	39	0.820
Indicator Point 4-1	29.763	41	0.726
Indicator Point 7-1	15.032	20	0.752
Total	76.769	100	

As shown in Figure 1, for indicator point 1-1, the target achievement value of 0.82 exceeds the expected 0.75, achieving the expected learning effect.

For indicator point 4-1, the target achievement value is 0.726, which does not reach the expected 0.75, and does not reach the expected learning effect. The reason is that the classroom teaching time is limited, and there is a lack of in-depth explanation of the experimental principle. At the same time, due to the limitation of class time, the experiment is mostly based on the teacher's demonstration, which makes the students' understanding of the experimental principle not deep enough, lacks the ability to train hands, and the specific strategy needs to be sustained later. Improve.

For indicator point 7-1, the goal achievement value is 0.752, slightly exceeding the expected value of 0.75, barely achieving the expected learning effect. Teachers also need to improve the teaching methods and teaching content in the classroom, and dig deep into the concept of green, environmental protection and sustainable development. Connotation, through innovative teaching methods, better combined with the "General Chemistry" curriculum to enhance students' learning outcomes.

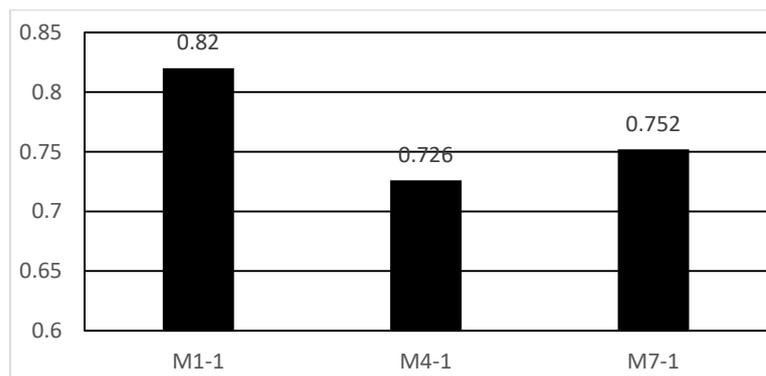


Figure 1 General Chemistry achievement analysis table

V Course Improvement

In recent years, for engineering education certification, colleges and universities that have established civil engineering majors in the country have carried out many reforms on training programs and teaching systems, especially the introduction of "general chemistry" into the curriculum system according to requirements, but due to professional characteristics, Most students have relatively strong physical foundations and relatively weak chemical foundations. It is relatively difficult to learn. In particular, a large part of the basic study of chemistry courses is to cultivate students' hands-on experimental ability training. Therefore, it is necessary to reflect carefully from the perspective of daily teaching. , regular feedback, continuous improvement.

(1) Pay attention to the achievement of the course objectives. In the course of teaching, the curriculum construction and student training based on learning results are continuously implemented. All teaching activities are carried out around the objectives of the course. Taking this article as an example, from the calculation results of the course completion degree, the achievement of the goal 2 is not ideal and needs to be taught. Adjust the teaching method, increase the interaction of experimental teaching or increase the experimental time to improve students' experimental ability and the ability to collect, organize and analyze experimental data.

(2) Increase the experimental teaching links of quantifiable assessment. In order to improve the quantifiable operation of the course achievement level and improve the learning effect of the course goal 2, in the future teaching process, as well as the revision of the syllabus and the formulation of the teaching plan, the experimental teaching solution for the quantifiable assessment can be appropriately increased. To ensure that the teaching process is consistent with the objectives of the course.

(3) Enhance the strength of teachers. Introducing excellent talents and outstanding young teachers, and at the same time aiming at the lack of engineering practice experience for young teachers, they are required to participate in the internship process, and at the same time select experienced practical teachers from the enterprise to ensure the cultivation of students' engineering ability.

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