

# An Improved Curriculum Evaluation Approach based on the Course of Mechanical Design

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**Abstract.** Improving the curriculum evaluation is of significance for promoting the teaching innovation and course construction of colleges and universities. In this paper, an improved curriculum evaluation approach would be developed based on the well-known educational philosophy of outcome-based education (OBE). The course of mechanical design was used as the research object of curriculum evaluation, as it is one of the important technical foundation courses for engineering students. Both the establishing and the implementing guidelines of the developed curriculum evaluation approach are addressed and discussed. It is of great importance that a more scientific curriculum evaluation approach can be established by merging OBE theory into course related reform.

**Keywords:** Curriculum evaluation; OBE; Mechanical design; Engineering education.

## 1. Introduction

Along with change of the times, the elite education has been transformed into the mass education. It brings some problems: such as the decline of education quality, the devaluation of diploma, etc. To solve these problems, the educational reform for higher education should be conducted including the reforms in teaching ideology, in teaching system and in teaching method. In terms of educational reform, teaching objectives, teaching plans, mode for talents cultivation, and teaching methods should be formulated under the background of the times. Courses and teaching are the core links to achieve the teaching objectives of colleges and universities. The curriculum evaluation is always the focus of course teaching. It is related to the realization of teaching objectives, the improvement of teaching methods and the feedback of teaching results.

In particular, in terms of the courses for engineering majors, these courses have their own characteristics, comparing with the other courses of non-engineering majors. In general, the practice teaching is one part of the courses for engineering majors. The curriculum evaluation for the engineering course should balance the weights in the theory teaching and practice teaching. The curriculum evaluation system has made great progress along with the reform of education. However, there are still some problems in the current curriculum evaluation system, such as the isolated evaluation standards, the lack of flexibility in evaluation methods, and the lack of comprehensiveness of evaluation subjects. The following questions are faced by the teachers, including: should outsiders or insiders carry out the evaluation and how should it be organized[1]? Outcome-based education (OBE) is an educational theory that bases each part of an educational system around outcomes[2]. If relevant concepts of OBE can be integrated into the curriculum evaluation system, it will be conducive to the development of curriculum teaching reform in colleges and universities[3].

The theory of OBE covers many aspects of education and has attracted wide attention in the field of education. In this paper, the concept of OBE would be introduced into the course evaluation, so as to realize the exploration and reform of curriculum evaluation. The course of mechanical design would be adopted as the research object of curriculum evaluation in this paper, as it is one of the important technical foundation courses for engineering students. Both the establishing and the implementing guidelines of the developed curriculum evaluation system would be addressed and discussed in the following sections.

## 2. Background on the Curriculum Evaluation

Humboldt, a famous educator, believed that human spiritual activities can flourish through cooperation[4]. The cooperation can make people learn from each other, and the success of one person in the team will inspire others to make continuous efforts, thus forming a healthy competition to promote each other and make continuous progress[4]. As defined by Humboldt, the relationship between teachers and students can be regarded as a kind of complementary and cooperative relationship. The teachers and students coexist for academic purposes. Teachers, as the carriers of knowledge, should train the professional abilities of students; in turn, students should participate in the academic research of teachers. It can be regarded as a cooperative, interactive and mutually reinforcing relationship between teachers and students[4]. Therefore, the curriculum evaluation should take into account the relationship between teachers and students. In curriculum evaluation, both the qualitative and quantitative indicators should be employed.

In addition, it is interesting to mention that what the OBE is. The OBE is an educational theory basing each part of an educational system around outcomes [2]. The outcome should be achieved by each student, by the end of the educational experience. In OBE, with the help of classes, assessments, and opportunities, students can achieve the specified outcomes[2]. In fact, a clear expectation of what needs to be accomplished by the end of the course could be created by focusing on outcomes. By focusing on outcomes, students will be able to understand what is expected of them. Meanwhile, what needs to be taught during the course could be understood by the teachers [5]. As a result, teachers can structure the corresponding lessons around the student's needs. Therefore, the OBE concept can be integrated into the curriculum evaluation for improving the abilities of students.

## 3. The Improved Curriculum Evaluation Approach

OBE is regarded as an innovation of education mode. Many of its advanced ideas can give some new inspiration to traditional ideas and methods. Integrating the OBE concept into the curriculum evaluation system and making some improvements in the original evaluation content, evaluation subject and evaluation criteria will help to promote the reform of higher education. The improved curriculum evaluation approach is given as follows:

(1) Considering both the self-assessment and external assessment in the curriculum evaluation.

In the current curriculum evaluation, the mastery of knowledge is overemphasized. However, the evaluation for the capability level of students is lacking to some extent. In general, the curriculum evaluation is based on the examination result and teaching effect, and lacks the interaction and participation with the outsiders. Outsiders, that is parents or the employers in future, should participate in the design and implementation of the curriculum evaluation. In the process of constructing the evaluation system of engineering courses, the following issues may be concerned: (I) the course objective can be determined based on the requirements of the employers in future. As a result, the evaluation methods and evaluation criteria can be improved, according to the modified course objective; (II) the curriculum evaluation should be updated with the change of times. The objective of course is required to be updated with the society need; (III) the establishment of course evaluation should have the strong operability. The evaluation indicators should be determined reasonably using the statistical principles. In this way, the abilities of students can be reflected comprehensively and accurately from multiple perspectives.

Taking the course of mechanical design as an example, the teaching of mechanical design course can be linked with the learning of some computer aided design soft wares (such as CAD, solid works, etc.). The single classroom-teaching form can be avoided by making full use of the functional modules of CAD software. These modules including the three-dimensional modeling, motion analysis, structural analysis and a variety of plug-ins. Combining the theory teaching with practical teaching can guide students to mask the whole process of mechanical design. In this way, the effective integration of the whole knowledge structures of mechanical design can be achieved. As a result, the teaching effect can be improved. From the evaluation of the main roles, curriculum evaluation can be classified as first-party evaluation (self-assessment), second-party evaluation (teacher-assessment),

and third-party evaluation (peer review). The third-party evaluation (peer review) can be conducted by the experts and scholars that are relevant to the courses evaluated. The weights of the first-party evaluation, the second-party evaluation and the third-party evaluation needs to be adjusted properly. Table 1 shows the weights of the first-party evaluation, the second-party evaluation and the third-party evaluation used in authors' course. It can be regarded as a reference.

Table. 1 The weights of the first-party evaluation, the second-party evaluation and the third-party evaluation.

Evaluation	First-party	Second-party	Third-party
Evaluators	Students	Teacher	Experts and scholars
Weights	15%	60%	25%

### (2) Considering both the results and the process in the curriculum evaluation

In the current curriculum evaluation, the learning effect of students is often evaluated based on scores and achievements. There is a lack of assessment and evaluation of other factors in the process of achieving learning outcomes. These factors are including: such as learning attitude, learning motivation and learning initiative. The assessment of learning process quality is lacked to some extent.

In fact, in the process of the curriculum evaluation, the teachers should take into account the students' extracurricular learning achievements. Taking part in various kinds of science and innovation competitions can be regarded as the learning process for the engineering students, as well as the following issues: such as journal publishing, patent application, engineering works, etc. The collection and retention of process data should be paid attention to. It is because that these process data in various activities can do a favor for the teachers to judge the learning attitude, learning motivation and learning initiative of students. Moreover, the improvement of students' abilities should be feed back to the corresponding students concerned timely.

Taking the course of mechanical design as an example, the continuity of students' ability training should be focused. The course of mechanical design can be regarded as a new platform to cultivate students' innovative abilities. On the basis of curriculum design, the extracurricular comprehensive practice should be strengthened. Teachers should encourage and organize students to participate in various innovative competitions, such as the mechanical engineering innovation competition, the innovation competition of college students, etc. Some interested students can be encouraged to participate in various academic activities. Both journal publishing and patent application can be regarded as additional sub-items of final curriculum evaluation. In this way, the students whose final examination scores are not ideal can be correctly evaluated by taking into account the process assessments.

### (3) Forming the closed-loop operation of the curriculum evaluation

In the implementation of current curriculum evaluation, the feedback mechanism is lacked to some extent. In general, the evaluation results of comprehensive quality are regarded as the feedback of the curriculum. After course, students lack the feedback platform for their personal developments. Whether the students meet the needs of the society for talents is not included in the feedback mechanism.

The teachers should establish a long-term and continuous tracking and feedback mechanism for curriculum evaluation. The requirements for the students and employers are regularly feed backed. In this way, the learning effects of students can be mastered in a timely manner. Based on the analysis and evaluation on the achieving degree of the requirements of the society on talent cultivation, the curriculum evaluation can be adjusted in time to realize the rapid response.

Taking the course of mechanical design as an example, through the analysis of course performance and students' feedback, the degree of students' ability to meet the standards can be evaluated and compared with the expected evaluation indicators. As a result, the existing problems can be found. These problems can be solved in the later teaching process, so as to promote students to achieve the desired learning effect. Fig. 1 shows the overview of the closed-loop feedback in the curricular emulation adopted in authors' course. It can be regarded as a reference.

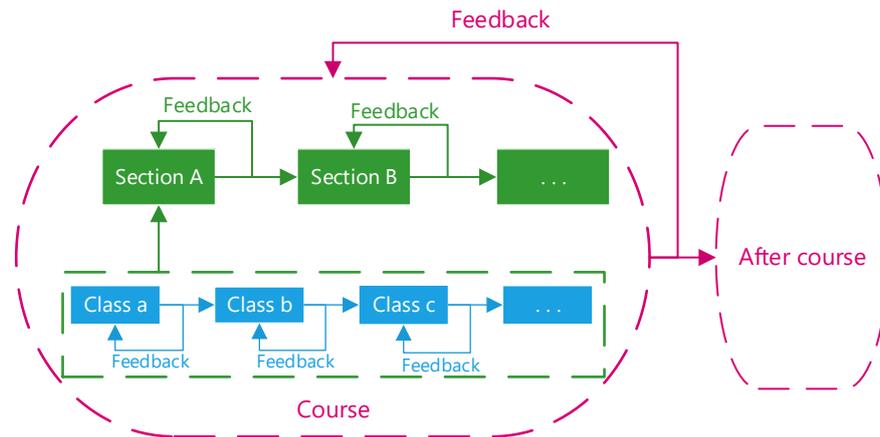


Fig. 1 the overview of the closed-loop feedback in the curricular emulation.

#### 4. Summary

In this paper, an improved curriculum evaluation approach for engineering course was developed by integrating the OBE concept. The curriculum evaluation system under the OBE mode is a bold attempt in engineering teaching. There are three points in the proposed approach. They are given as follows:

First, both the self-assessment and external assessment should be considered in the improved curriculum evaluation approach. From the evaluation of the main roles, curriculum evaluation can be classified as first-party evaluation (self-assessment), second-party evaluation (teacher-assessment), and third-party evaluation (peer review). The third-party evaluation (peer review) can be conducted by the experts and scholars that are relevant to the courses evaluated.

Second, the results as well as the process should be evaluated in the improved curriculum evaluation. Taking part in various kinds of science and innovation competitions can be regarded as the learning process for the engineering students, as well as the following issues: such as journal publishing, patent application, engineering works, etc. The collection and retention of process data should be paid attention to. They can help the teachers to evaluate the learning attitude, learning motivation and learning initiative of students.

Third, forming the closed-loop operation of the curriculum evaluation. The teachers should establish a long-term and continuous tracking and feedback mechanism for curriculum evaluation. The requirements for the students and employers are regularly feed backed.

#### Acknowledgements

This study is sponsored by Shanghai Sailing Program (19YF1434500).

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