
Optimization Exploration of Student Evaluation of Teaching System Based on OBE Concept

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Abstract: Outcome-Based Education is a globally recognized philosophy for quality assurance in higher education, emphasizing the definition of student learning outcomes and the use of backward design in both teaching and assessment. This study systematically analyzes the current situation and existing challenges in Student Evaluation of Teaching practices at Qilu University of Technology. In response, an optimized evaluation framework is proposed, featuring outcome-oriented indicators, multi-stakeholder participation, process-based assessment, effective feedback mechanisms, and the cultivation of an evaluative culture. This framework aims to strengthen the alignment of SET with OBE principles and engineering education accreditation standards, providing practical support for enhancing teaching quality and promoting the cultivation of application-oriented talents.

Keywords: OBE; engineering education accreditation; student evaluation of teaching; application-oriented talent cultivation

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1. Introduction

With the continuous advancement of the connotative development of higher education, teaching quality has become a key component of universities' core competitiveness. Student evaluation of teaching (SET), as an essential element of the teaching quality assurance system, serves not only as an important channel for reflecting teaching effectiveness and promoting teachers' professional development, but also as a crucial mechanism for improving teaching management and enhancing students' learning experiences.

Outcome-Based Education (OBE) has gained increasing attention as an important guiding philosophy for educational evaluation reform^[1-2]. Originating in the United States in the 1980s, OBE emphasizes starting from the expected learning outcomes of students and designing teaching objectives, teaching processes, and evaluation methods accordingly through backward design^[3-5]. Compared with traditional teacher-centered evaluation approaches, OBE focuses on what students have actually learned and what they are able to do after the learning process.

Qilu University of Technology (QLU) is an application-oriented university which has clearly established its educational objective of cultivating high-quality application-oriented talents with solid foundations, rigorous work styles, and strong innovative and practical abilities. In recent years, the university has actively promoted and successfully passed engineering education accreditation, such as Mechanical Engineering, Bioengineering, Electronic Information Engineering, Chemical Engineering and Technology, Environmental Engineering and Light Chemical Engineering. These accredited programs have taken the lead in implementing OBE-based teaching reforms. Zhang et al.^[6] explored the implementation of course-based ideological and political education at the program level under the OBE framework, and clarified the specific objectives and implementation pathways for individual courses. Zhang et al.^[7] reconstructed the Mechanical Drawing course based on the OBE concept, and organized discipline competitions in graphics to promote learning and teaching based on the concept of continuous improvement. Wang et al.^[8] carried out innovative reform and practice in the teaching model of the Analytical Chemistry course based on the OBE concept, optimized the teaching content, innovated teaching methods, and subsequently improved the assessment system. Luo et al.^[9] implemented the OBE concept in the teaching processes of printing and packaging engineering to improve teaching practices and enhance educational quality, and conducted reforms and explorations at the levels of program, curriculum, methods, and mechanisms.

However, in practice, the current SET system at Qilu University of Technology still largely follows traditional evaluation models, which prevent the system from fully reflecting the OBE principle and reduce its effectiveness in supporting talent cultivation and accreditation quality assurance. Therefore, it is necessary to systematically analyze the existing problems in the current SET system, and explores feasible optimization paths grounded in OBE principles and engineering education accreditation standards.

2. Core connotation of OBE and connection with student evaluation of teaching

2.1. Core connotation of OBE concept

The core of OBE concept lies in being outcome-oriented, whose connotation can be summarized into “three reverse designs” and “four core principles”. The “three reverse designs” refer to: taking expected learning outcomes as the starting point to reversely design the curriculum system, teaching content and methods; taking the achievement of learning outcomes as the core to reversely design the evaluation system and standards; and taking evaluation feedback as the basis to reversely optimize the teaching process and talent cultivation plan. The “four core principles” include clarifying expected learning outcomes, focusing on the achievement of outcomes, attaching importance to evaluation feedback and improvement, and emphasizing full participation and collaboration. Different from the traditional teaching-centered evaluation model, OBE-oriented evaluation focuses more on what students have learned and can do rather than what teachers have taught, and its core goal of promoting the improvement of students’ learning outcomes and teaching quality.

2.2. Connection between OBE and SET

As an important component of university teaching quality evaluation, SET serves as a key mechanism for implementing the OBE concept, and the two are closely interconnected. On the one hand, OBE provides essential guidance for optimizing the SET system by emphasizing the achievement of students’ learning outcomes. It requires that evaluation indicators and standards be designed around learning outcome attainment, thereby overcoming the limitations of traditional SET practices that tend to “emphasize form over effectiveness” and “focus on process rather than results.” On the other hand, a scientific and well-structured SET system can effectively reflect the degree to which students achieve their learning outcomes. It can also provide valuable data to support the optimization of teaching processes, the adjustment of curriculum systems, and the improvement of teachers’ instructional capabilities, thereby promoting the transition of the OBE concept from the theoretical level to practical implementation.

3. Situation and problems of existing SET system in QLU

3.1. Current situation of the SET system

The current SET system of Qilu University of Technology consists of four parts: organization, indicators, process and application of results. In terms of organizational management, the Academic Affairs Office takes the lead, with the cooperation of secondary colleges, and relevant teaching quality evaluation departments are responsible for the organization, implementation, supervision and data summary and analysis of SET. In terms of evaluation indicators, a unified evaluation scale is adopted, covering teaching attitude, teaching content, teaching methods and teaching effect, with several specific indicators under each dimension and a 5-point Likert scale for scoring. In terms of evaluation process, SET is mainly carried out at the end of each semester through an online evaluation system, and the results are used as an important reference for teachers' performance appraisal, professional title evaluation, and selection of outstanding teachers. In terms of practical exploration, engineering education accredited programs in QLU have carried out teaching reform combined with the OBE concept. However, from the perspective of daily SET organization, supervision and data analysis, as well as the core requirements of OBE and the quality standards of engineering education accreditation, there are still many urgent problems to be solved, which is not conducive to the improvement of the teaching quality monitoring system.

3.2. Existing problems of the SET system

3.2.1. Homogenization of evaluation indicators

The current evaluation indicators adopt a "one-size-fits-all" model that fails to consider the characteristics of different disciplines and course types within the university. Moreover, they are not fully aligned with the core requirements of engineering education accreditation, which emphasize the cultivation of engineering practice competence and innovative capability.

Based on routine sorting and analysis of SET data, two major issues can be identified. First, the existing indicators mainly focus on evaluating teachers' teaching performance, such as "whether the teaching attitude is serious" and "whether the teaching content is systematic." Insufficient attention is paid to students' learning processes, attainment of learning outcomes, and key competencies emphasized in engineering education accreditation, including engineering practice ability, the ability to solve complex engineering problems, and professional literacy. Second, the evaluation indicators lack differentiation across disciplines and course types. The same set of indicators is applied to practical courses in engineering programs that have passed engineering education accreditation, theoretical courses in liberal arts majors, and public basic courses. Such homogenization makes it difficult to accurately reflect the teaching objectives and learning outcomes associated with different types of courses.

3.2.2. Singleness of evaluation subjects

OBE emphasizes broad participation and collaboration in the evaluation process, and engineering education accreditation explicitly requires the establishment of a multi-source evaluation mechanism. However, the current SET system in the university relies solely on students as the evaluation subjects, lacking participation from other stakeholders such as teachers, teaching supervisors, and enterprise mentors.

During the supervision of SET activities, it has been observed that students' evaluations are often influenced by their cognitive level, learning attitudes, and personal preferences, which may result in subjectivity and one-sidedness in the evaluation outcomes. Some students treat SET merely as a routine task and may complete the evaluation casually or randomly, thereby affecting the reliability and scientific validity of the results and reducing their value for guiding teaching improvement. Furthermore, teachers' self-evaluation, supervisors' evaluation, and enterprise mentors' feedback are not incorporated into the SET system. As a result, the evaluation framework cannot comprehensively reflect the teaching process or accurately assess the extent to which students' learning outcomes have been achieved.

3.2.3. Formalization of evaluation process

OBE emphasizes process-oriented evaluation and highlights the importance of dynamically monitoring the attainment of students' learning outcomes throughout the teaching process. Similarly, engineering education accreditation requires the establishment of a comprehensive quality monitoring system covering the entire teaching process.

However, the university's current SET practice is primarily conducted at the end of the semester and functions as a one-time summative evaluation. Such an approach cannot provide timely feedback on problems arising during the teaching process or capture the dynamic changes in students' learning outcomes. Consequently, the evaluation results lack timeliness and relevance, which is inconsistent with the full-process evaluation requirements of engineering education accreditation. In addition, there is a lack of systematic guidance for students before participating in SET. Some students have only a vague understanding of the meaning of the evaluation indicators and the core requirements of engineering education accreditation. This often leads to superficial or formalized evaluation responses, which weakens the diagnostic and improvement functions of SET and increases the difficulty of subsequent data analysis.

3.2.4. Fragmentation of result application

A core principle of OBE is the establishment of a closed-loop mechanism of "evaluation-feedback-improvement," and engineering education accreditation likewise requires a quality assurance system that supports continuous improvement. However, the current SET system at the university places greater emphasis on evaluation than on the effective utilization of its results, reflecting a tendency to prioritize outcomes over feedback.

In practice, SET results are mainly used for teachers' performance appraisal and professional title evaluation, while specific evaluation comments and improvement suggestions are rarely communicated to teachers in a timely and systematic manner. Consequently, teachers cannot clearly identify the problems existing in their teaching practices or make targeted improvements to their instructional processes, which fails to meet the continuous improvement requirements of engineering education accreditation. Moreover, the evaluation results are rarely linked to the optimization of the curriculum system or the adjustment of talent cultivation plans, nor are the results and their applications communicated back to students. This leads to a breakdown in the evaluation–feedback–improvement cycle and prevents SET from fully performing its guiding and improvement functions.

3.2.5. Lack of evaluation culture

Both the implementation of OBE and the advancement of engineering education accreditation require the support of a sound evaluation culture. However, the university has not yet formed a sufficient SET culture that promotes teaching and learning improvement through evaluation.

Some teachers attach limited importance to SET, perceiving it as a formal procedure rather than a meaningful mechanism for teaching improvement. As a result, they may overlook the improvement suggestions derived from evaluation feedback and fail to fully recognize the significance of SET in enhancing teaching quality and ensuring compliance with engineering education accreditation standards. Similarly, some students lack awareness of the importance of SET and believe that it has little relevance to their own learning. Their motivation to participate seriously in the evaluation process is therefore limited, and some may complete the evaluation perfunctorily or assign scores randomly, which significantly reduces the reliability and effectiveness of the evaluation results. At the same time, the anonymity guarantee mechanism for SET has not been sufficiently publicized. Some students worry that honest evaluations might affect their course grades and therefore hesitate to provide genuine feedback. This further undermines the objectivity of the evaluation results and contradicts the rigorous and pragmatic quality culture required by engineering education accreditation, while also increasing the difficulty of conducting effective teaching quality evaluation.

4. Optimization paths of SET system based on OBE concept

Based on the principles of OBE, this study proposes an optimized SET system characterized as “outcome-oriented, multi-agent collaborative, process-based closed-loop, and practice-oriented.” The optimization paths are explored from five aspects: the evaluation indicator system, the structure of evaluation subjects, the evaluation process model, the application of evaluation results, and the cultivation of evaluation culture.

4.1. Optimizing the evaluation indicator system

To address the limitations of homogenized evaluation indicators, a three-dimensional framework consisting of general indicators, individual indicators, and outcome indicators should be established to integrate the evaluation of teaching performance and learning outcomes. General indicators apply to all courses and instructors and focus on basic aspects such as teaching attitude, teaching standardization, and teaching feedback, ensuring the completion of fundamental teaching tasks. Individual indicators are designed according to disciplinary and course characteristics. While outcome indicators emphasize the achievement of students’ competencies, reflecting the core requirements of OBE.

To enhance the relevance of the indicators, differentiated individual indicators should be developed for different disciplines. For engineering programs such as Mechanical Design, Manufacturing and Automation and Electronic Information Engineering, evaluation should emphasize engineering practice competence and the ability to solve complex engineering problems, incorporating indicators such as the rationality of practical teaching design and improvement of engineering operational ability. For programs such as Environmental Engineering and Chemical Engineering and Technology, indicators may include adaptability of practical projects, competence in pollution control or process optimization, and engineering ethics awareness. Programs such as Food Science and Engineering and Light Chemical Engineering should emphasize alignment with industry demands, including the integration of industry cases and the cultivation of innovative practical ability. For liberal arts majors and general education courses, the evaluation should focus respectively on humanistic literacy, communication ability, and the cultivation of comprehensive qualities.

Outcome indicators represent the core of the evaluation system and assess whether students achieve expected learning outcomes in terms of professional knowledge mastery, practical competence, innovative ability, and professional literacy. Indicators such as engineering practice ability, complex problem-solving ability, engineering ethics awareness, and job adaptability should therefore be incorporated. In addition, indicators evaluating the effectiveness of curriculum-based ideological and political education can be included to encourage teachers to emphasize students’ professional competence and ethical awareness.

To maintain the effectiveness of the evaluation system, a dynamic adjustment mechanism should be established. Under the coordination of the Academic Affairs Office, evaluation indicators can be periodically reviewed in collaboration with secondary colleges, enterprise mentors, and program leaders, taking into account curriculum reform, industry demand, and accreditation requirements. Through expert consultation and feedback from teachers and students, the feasibility and recognition of the indicators can be further improved.

4.2. Improving the structure of evaluation subjects

To improve the objectivity and comprehensiveness of SET, a multi-agent evaluation mechanism should be established. Students remain the critical evaluators because they are direct participants in teaching activities. However, pre-evaluation training should be strengthened to help students understand the purpose of SET and the meaning of evaluation indicators, thereby reducing subjectivity and random responses. Meanwhile, the anonymity mechanism should be clarified to ensure that evaluation results are used only for teaching improvement and teacher assessment, encouraging students to provide honest feedback.

Teachers’ self-evaluation should also be incorporated into the SET system. Through reflective assessment of teaching processes, teaching effectiveness, and students’ learning outcomes, teachers can identify existing problems and formulate improvement measures. When combined with students’ evaluations and supervisors’ assessments, teachers’ self-evaluation

contributes to a more comprehensive understanding of teaching quality and promotes continuous improvement.

Teaching supervisors play an important role in ensuring the professionalism of evaluation. Relying on the university's Teaching Supervision Committee, a supervision team composed of senior teachers and teaching experts can conduct routine classroom observations and provide professional feedback on the alignment between teaching objectives and learning outcomes, the appropriateness of teaching methods, and the effectiveness of practical teaching.

Enterprise mentors should also participate in SET, particularly in engineering programs. Based on industry standards and practical experience, they can evaluate students' practical competence, professional literacy, and job readiness, thereby strengthening the connection between university education and industry needs.

4.3. Innovating the evaluation process model

To meet the process-oriented requirements of OBE, the SET system should move beyond the traditional end-of-semester evaluation and establish a process-based evaluation model. Evaluation activities can be conducted two to three times during the semester to assess teaching processes, students' learning status, and intermediate learning outcomes. Mid-semester evaluations allow students to provide feedback on teaching methods and course content, enabling instructors to adjust their teaching strategies in a timely manner.

After the completion of practical teaching activities, students and enterprise mentors may jointly evaluate the effectiveness of practical training to ensure that it effectively improves students' practical abilities. Process evaluation can combine online and offline approaches, with online platforms used for efficient data collection and offline discussions used to obtain deeper feedback.

At the end of the semester, summative evaluation should be conducted to comprehensively assess teaching effectiveness and the final achievement of students' learning outcomes. The final evaluation should integrate process evaluation results, students' academic performance, teachers' self-evaluation, supervisors' assessments, and enterprise mentors' feedback. In addition, open-ended questions can be included to encourage participants to provide specific suggestions for teaching improvement.

Digital technologies can further enhance the efficiency of SET. By relying on the university's smart teaching management platform, evaluation data can be automatically collected, analyzed, and summarized into reports. Mobile evaluation functions can facilitate participation by students and enterprise mentors, while data analysis technologies can help identify underlying problems in teaching practices and provide evidence-based support for continuous improvement.

4.4. Strengthening the application of evaluation results

The effectiveness of SET depends largely on the rational use of evaluation results. Therefore, a precision feedback mechanism should be established. After SET is completed, teaching quality evaluation departments and secondary colleges should analyze evaluation data and generate feedback reports for instructors. These reports should highlight key issues in teaching, summarize major suggestions from students and enterprise mentors, and evaluate the achievement of learning outcomes.

Based on the feedback, teachers should formulate targeted teaching improvement plans that clarify specific measures and implementation timelines. Secondary colleges should supervise the implementation of these plans and evaluate their effectiveness. Teachers who demonstrate significant improvement may receive recognition and incentives, while those with unsatisfactory results should receive further guidance.

SET results should also serve as an important reference for optimizing curriculum systems and adjusting talent cultivation plans. By regularly analyzing SET data, teaching management departments and colleges can identify courses with low evaluation results or insufficient learning outcomes and adjust course content, teaching methods, or syllabi accordingly.

In addition, SET results should be linked with teachers' performance evaluation and professional development. Appropriate weight can be assigned to SET outcomes in performance appraisal, professional title promotion, and teaching

awards, encouraging instructors to actively improve teaching quality.

4.5. Cultivating a sound evaluation culture

The effective operation of the optimized SET system requires the support of a positive evaluation culture. Universities should strengthen publicity on the OBE concept and the significance of SET through various channels such as official websites, social media platforms, and professional training programs. Regular seminars and workshops can also be organized to promote communication between teachers and students and enhance their understanding of evaluation activities.

An incentive mechanism should be established to encourage active participation in SET among teachers, students, and enterprise mentors. Students who provide constructive feedback may receive recognition in comprehensive quality evaluations, while teachers who effectively respond to evaluation feedback and achieve notable teaching improvements can be rewarded with commendations and professional development opportunities. Enterprise mentors who contribute valuable suggestions may receive letters of appreciation and priority opportunities for further collaboration.

Finally, universities should foster a collaborative atmosphere that values teaching quality and continuous improvement. Activities such as teaching quality improvement campaigns and teaching excellence awards can help create a positive evaluation environment. At the same time, enhancing the transparency of SET through the regular publication of evaluation results and improvement measures can strengthen trust in the evaluation system and promote a culture of shared responsibility for teaching quality.

5. Conclusions

Guided by the principles of OBE and the requirements of engineering education accreditation, this study examined the current situation of the SET system at Qilu University of Technology. Through an analysis of existing practices, several key problems were identified, including the homogenization of evaluation indicators, the singleness of evaluation subjects, the formalization of the evaluation process, the fragmentation in the application of evaluation results, and the lack of a sound evaluation culture. In response to these issues, this paper proposed optimization paths for the SET system from five perspectives: the construction of a diversified evaluation indicator system, the establishment of a multi-agent evaluation mechanism, the innovation of a process-oriented evaluation model, the strengthening of the application of evaluation results, and the cultivation of a supportive evaluation culture. These measures aim to promote the alignment between SET and the OBE concept, improve the scientificity and effectiveness of teaching evaluation, and support the continuous improvement of teaching quality in application-oriented universities. In the future, further efforts can be made to deepen the integration of the OBE concept into SET practices and to explore more data-driven and digitalized evaluation approaches.

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Disclosure statement

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