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Application of Outcome-Based Education in Teaching English for Chemical Engineering

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Abstract: This paper explores the current application status and innovative strategies of the outcome-based education (OBE) in teaching English for chemical engineering . It identifies several issues in the current teaching of English for chemical engineering , such as the disconnect between course objectives and industry needs, insufficient practical application of teaching content, delayed faculty development, lack of teaching resources, and imperfect evaluation systems. Solutions such as improving the curriculum system, strengthening faculty training, constructing a diversified evaluation mechanism, deepening school-enterprise cooperation, and promoting the sharing of information-based resources are proposed. Practical evidence shows that integrating the outcome-based education into English teaching for chemical engineering can effectively enhance students' professional English application abilities and overall competence, thereby promoting the comprehensive improvement of the teaching quality of English for chemical engineering in colleges.

Keywords: Outcome-Based Education; English for Chemical Engineering; Teaching Reform

Introduction

With the acceleration of globalization and the increasing frequency of international exchanges in the chemical engineering industry, English for chemical engineering has gained significant attention as an essential skill for chemical engineering majors. However, the traditional teaching model of English for chemical engineering is struggling to meet the demands of the modern chemical industry for versatile talents. The outcome-based education (OBE) emphasizes the evaluation of learning outcomes and the cultivation of professional skills, offering new ideas for the reform of teaching English for chemical engineering[1]. This paper analyzes the current issues in the teaching of English for chemical engineering and explores strategies for applying the outcome-based education. The aim is to establish an innovative teaching model that meets the needs of the chemical industry, enhancing the English proficiency and international competitiveness of chemical engineering students.

1. Current Situation and Issues in Teaching English for Chemical Engineering

1.1 Disconnect Between Course Objectives and Industry Needs

Currently, the course objectives in teaching English

for chemical engineering focus too much on language knowledge transmission, neglecting the cultivation of practical application skills in the industry. When setting course objectives, there is a lack of research into the employment needs of chemical enterprises, which results in a failure to accurately grasp new trends in the industry's development and new requirements for international communication. Some universities continue to adhere to traditional teaching goals, emphasizing vocabulary and grammar explanations while undervaluing the development of professional communication skills. This has led to a clear gap between talent cultivation and the demands of the industry. Multinational chemical companies require employees to have diverse skills such as professional English communication, reading technical documents, understanding contract texts, and conducting business negotiations, yet current course objectives fail to address these core workplace competencies[2].

After graduation, students often find that the English knowledge they acquired is insufficient to meet the practical challenges in the workplace. This reflects a lack of foresight and systematic planning in the setting of course objectives. With the advancement of the construction of new engineering disciplines, the cultivation of chemical engineering talent must align with the needs of the industrial chain. However, the adjustment of professional English course objectives lags behind the pace of industry transformation. Although some colleges have recognized this issue, reforms often remain superficial, failing to fundamentally restructure the course objective system. The formulation of course objectives is often formalistic, lacking quantitative indicators to support them, making it difficult to implement effective teaching evaluations[3].

1.2 Insufficient Practical Application in Teaching Content

The teaching content of English for chemical engineering generally suffers from a lack of specialization and practical applicability. The textbooks often use general professional English materials, which are outdated and fail to reflect the latest technological advancements and industry trends in the chemical field. The content arrangement tends to overly focus on textbook knowledge explanations, with a large portion of classroom time spent on memorizing professional vocabulary, while neglecting to create language application scenarios and provide practical opportunities[4]. As an applied course, the teaching content of English for chemical engineering should cover English application scenarios throughout the entire chemical production process, including experimental operation guidance, understanding safety protocols, explaining process flows, and reading equipment maintenance documents. However, in actual teaching, these topics are underrepresented.

Although some colleges have introduced case-based teaching, many of the cases are derived from textbooks or the personal experiences of instructors, lacking real-world work context. As a result, students are unable to establish connections between knowledge and practical applications. Chemical engineering industry is a rapidly evolving field, with emerging areas such as green chemistry and smart manufacturing, yet English terminology and expressions related to these new technologies have not been incorporated into the teaching content in a timely manner.

1.3 Mismatch Between Faculty Background and Professional Needs

The teaching of English for chemical engineering faces the issue of an imbalanced faculty structure. Most instructors for professional English courses come from either foreign language departments with an English teaching background or from chemical engineering departments. While the former have the necessary language teaching skills, they lack a solid background in chemical engineering industry, making it difficult for them to accurately interpret and teach professional content. On the other hand, the latter possess the expertise in the field but often lack the necessary teaching skills in English, which limits the effectiveness of their instruction. The mechanism for cultivating professional English teachers is underdeveloped, with a lack of systematic training programs and career development paths, which impedes the professional growth of instructors.

The lack of practical experience in the chemical industry makes it difficult for teachers to integrate cutting-edge technological developments and industry demands into their teaching. Opportunities for international academic exchange are limited, leaving teachers unable to fully grasp the global trends in chemical engineering teaching. Although

some colleges have attempted to establish dual-teacher teaching teams, these collaboration models are often underdeveloped and tend to remain superficial. Additionally, the varying levels of teachers' information technology application skills affect the effectiveness of modern teaching methods.

1.4 Insufficient Teaching Resources and Lack of Information Technology Integration

The development of teaching resources for English for chemical engineering is lagging behind, with a low level of information technology application. Quality textbooks and supplementary resources are scarce, and the existing textbooks have long update cycles, making it difficult to keep up with the rapid developments in industry technologies. There is insufficient investment in the development of multimedia teaching resources, and the construction of a professional English audio and video material library lacks a systematic plan. The integration of virtual simulation experiment platforms with learning English for chemical engineering is weak, and students lack an immersive learning environment.

The inter-institutional sharing mechanism for professional English teaching resources is not well-established, leading to duplicated resource investments and low utilization rates. The construction of a specialized English corpus for chemical engineering began relatively late and lacks targeted language learning data support. There is insufficient development of mobile learning applications, making it difficult to meet students' needs for fragmented learning. The application of intelligent assessment tools is also limited, making it challenging for teachers to access data on students' learning progress and make precise adjustments to their teaching methods.

1.5 Inadequate Evaluation System and Insufficient Student Engagement

The evaluation system of teaching English for chemical engineering has several shortcomings. Traditional evaluation methods place excessive emphasis on final exam scores, neglecting the assessment of the learning process and the evaluation of students' performance in terms of skills and application. The evaluation criteria are narrow, primarily measuring language knowledge acquisition rather than practical application abilities. The evaluation process is mainly teacher-centered, with a lack of involvement from students through self-assessments, peer evaluations, or evaluations from chemical engineering industry professionals. Additionally, the content of evaluations is disconnected from the vocational skills required in the field, making it difficult to reflect students' actual proficiency in applying professional English.

Students' motivation to learn professional English is insufficient, and their engagement is insufficient. This is reflected in their lack of enthusiasm for classroom interaction and limited time spent on independent learning after class. Some students view the professional English course merely as an exam requirement and fail to recognize its importance for their future career development. Furthermore, the evaluation feedback system is underdeveloped, and students struggle to adjust their learning methods and strategies based on the evaluation results. The absence of standards for evaluating practical skills leads to subjective and arbitrary assessments of students' abilities to apply professional English. Additionally, the evaluation results are not effectively used to guide teaching improvements and course adjustments.

2. Strategies and Innovative Practices to Apply Outcome-Based Education

2.1 Improving the Curriculum System and Redefining Course Objectives

Based on the OBE, the restructuring of the curriculum system for English for chemical engineering should begin by clearly defining expected learning outcomes and measurable objectives, following the "backward design" principle to develop a pathway for achieving the required competencies. A research team should conduct in-depth industry needs analysis by engaging with chemical enterprises and inviting industry experts to participate in the formulation of course objectives, ensuring that the goals align with the development of the industry chain and the needs of international communication.

An integrated design framework should be established, linking "learning outcomes – teaching content – teaching activities – evaluation standards" to strengthen the guiding role of outcome-based education and the focus on competency development goals. The course objectives for English for chemical engineering should be broken down into a matrix of core competency indicators, including professional

literature reading ability, technical report writing ability, international communication skills, and professional conference participation ability. For each competency, clear, measurable performance standards and evidence collection methods should be established, forming a quantitative evaluation system for measuring the achievement of these objectives.

Under the guidance of the outcome-based education, a modular curriculum for English for chemical engineering should be constructed, including progressive courses such as basic professional English, chemical engineering literature reading, interpretation of international standards and norms, and business English for chemical engineering industry. These courses should meet the varying needs for different career development paths and competency levels. By continuously collecting industry feedback and conducting graduate tracking surveys, the evolving career development needs of students should be closely monitored. The course objectives and content should be regularly revised to ensure the curriculum remains forward-looking and adaptable to industry changes.

2.2 Strengthening Faculty Training and Professional Competency Enhancement

The OBE emphasizes a shift in the role of teachers, from knowledge transmitters to learning facilitators and competency development guides. This requires the implementation of a systematic dual-teacher training plan and the establishment of a long-term mechanism for the development of the faculty in English for chemical engineering. Schools should organize regular teacher participation in practical training within chemical enterprises based on the OBE. This will allow teachers to gain a deeper understanding of the latest technological developments in the industry and the application of English in professional contexts, helping them grasp the language competency needs specific to various professional situations. At the same time, it is important to encourage English teachers to engage in basic courses in chemical engineering to improve their professional knowledge base and understanding of technical terminology. Chemical engineering faculty should also be supported to participate in training programs focused on outcome-based teaching methods and professional English teaching skills enhancement to improve both their language teaching abilities and teaching design skills.

Schools should establish international exchange programs for faculty, sending key teachers to overseas universities or enterprises for further study, allowing them to learn about international advanced outcome-based teaching models and methods for teaching professional English. This will enhance their global perspective and cross-cultural teaching competence. Additionally, schools should improve the faculty evaluation and incentive mechanisms, incorporating teaching reform results, student performance improvements, and innovations in outcome-based teaching practices into the assessment criteria. This will stimulate teachers' enthusiasm for teaching and drive the motivation for further reform. Furthermore, schools should involve teachers in the development of outcome-based teaching resources, such as writing professional English textbooks and accompanying digital resources that are aligned with learning outcomes, ensuring that the teaching materials are consistent with course objectives.

2.3 Constructing a Diversified Evaluation System and Feedback Mechanism

Based on the core principles of OBE, a comprehensive, multi-dimensional evaluation system should be developed for the entire process of teaching English for chemical engineering. In this system, evaluation is seen as a process for collecting evidence of learning outcomes rather than merely a means of judgment. The traditional assessment methods should be reformed by combining summative and formative evaluations. Multiple evaluation methods and diverse evidence collection approaches should be employed to verify the achievement of learning outcomes, focusing on both the evaluation of the learning process and the assessment of skills performance. A multi-dimensional evaluation matrix should be designed based on expected learning outcomes, including indicators such as professional vocabulary mastery, literature reading comprehension, technical communication skills, and report writing ability. The relationship between evaluation indicators and competency goals should be clearly mapped to ensure that the evaluation content comprehensively covers the core learning outcomes. Additionally, a task-driven evaluation method should be introduced, where students' ability to apply professional English and solve problems in workplace contexts is assessed through completing real-world language tasks in simulated

chemical engineering work scenarios.

2.4 Deepening School-Enterprise Cooperation and Innovating the Practical Teaching Model

Following the principles of outcome-based education, deepening school-enterprise cooperation should focus on the practical application of learning outcomes and the development of professional skills. A school-enterprise cooperation committee should be established, with enterprises actively involved in the entire process of professional English talent cultivation, jointly formulating practical teaching plans. A three-tiered practical teaching system should be established, comprising classroom teaching, simulation training, and enterprise practice. This system will strengthen the development of applied abilities, incorporating real workplace scenarios from enterprises and creating contextualized teaching cases, such as international project cooperation, technical exchange meetings, and product manual writing modules. Additionally, students should be encouraged to participate in enterprise technical document translation projects, which will link learning content with actual work tasks and improve the effectiveness of their learning.

Schools should also implement a dual-mentor system, where in-school teachers focus on fundamental knowledge delivery and enterprise engineers provide guidance on practical application. This collaboration will help students develop their ability to apply knowledge, ensuring a seamless integration of theory and practice, which aligns with the core philosophy of OBE that emphasizes the achievement of learning outcomes. To motivate students, schools can organize English for chemical engineering skills competitions, inviting enterprise representatives to serve as judges. This will foster student engagement and enthusiasm. Furthermore, schools should implement an "enterprise into the classroom" initiative, regularly inviting industry experts to deliver specialized lectures and share international cooperation experiences. This will broaden students' international perspectives and synchronize learning outcomes with the development of the global chemical engineering industry.

2.5 Advancing Information Resource Sharing and Optimizing Teaching Platforms

Based on the principles of OBE, the development of information technology resources for English for chemical engineering should focus on the visualization of learning outcomes and the monitoring of learning processes. A specialized learning platform should be developed that integrates course resources, interactive discussions, online assessments, and learning analytics. This platform should track students' learning progress throughout the course, with a focus on continuous improvement under the guidance of outcome-based education. The platform design should be built in reverse from the expected learning outcomes, establishing learning paths and evaluation nodes to ensure that each teaching segment serves the ultimate goal of competency development. A multi-tiered resource library for English for chemical engineering should be established, including modules for graded professional vocabulary, literature databases, case studies, video resources, etc. Each resource module should be tagged with corresponding competency indicators and application scenarios, allowing students to select the most appropriate resources based on their individual development needs. This will enable personalized learning and precise evaluation under an outcome-based framework.

Conclusion

The application of outcome-based education in the reform of teaching English for chemical engineering has proven effective in addressing many of the existing issues in the current teaching system. Through a series of measures, including refining the curriculum system and reshaping course objectives, enhancing faculty development, building a diversified evaluation mechanism, deepening school-enterprise cooperation, innovating practical teaching models, and advancing information resource sharing and platform construction, the English application abilities and professional competitiveness of chemical engineering majors have been significantly improved. The outcome-based education concept emphasizes a student-centered approach and competency development goals, bringing a fresh perspective and methodological guidance to the teaching of English for chemical engineering.

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