

Exploration of Teaching Reform for "Frontier Lectures on Optoelectronic Information" in the Context of OBE-Oriented Engineering Education Accreditation

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Abstract

"Frontier Lectures on Optoelectronic Information" is a practical compulsory course for undergraduates majoring in Optoelectronic Information Science and Engineering and is one of the courses involved in engineering education accreditation. The rapid development of optoelectronic information-related technologies makes the current teaching content abstract and broad, posing challenges in accurately capturing the latest knowledge in the optoelectronic industry. The course lacks specialized textbooks and unified standards and requirements. Guided by the OBE educational concept, the course explores teaching reform through the reconstruction of teaching objectives, optimization of course content, student-centered and outcome-oriented teaching activities, and reform of the grading evaluation system. This exploration aims to build a teaching framework that meets the graduation requirements of engineering education accreditation.

Keywords

Optoelectronic Information Science and Engineering; Frontier Lectures; Professional Accreditation; Teaching Reform.

1. Introduction

The concept of Outcome-Based Education (OBE) first emerged in the educational reforms of the United States and Australia in the 1980s. Upon its introduction, it gained widespread recognition among universities worldwide. In China, the outcome-oriented educational philosophy was first applied in the development of engineering programs. This concept addresses the core issues of education by shifting the focus from teaching to learning, emphasizing the improvement of teaching quality, and ensuring continuous improvement measures [1-3]. In 2018, the Ministry of Education, the Ministry of Finance, and the National Development and Reform Commission issued the "Guiding Opinions on Accelerating the Construction of 'Double First-Class' Universities." In 2019, the General Office of the Ministry of Education released the "Notice on Implementing the 'Double Ten Thousand Plan' for First-Class Undergraduate Program Construction," both of which emphasize that the construction of first-class undergraduate programs and disciplines based on engineering education accreditation provides a strong guarantee for the quality of talent cultivation and promotes the steady progress of teaching activities [4,5].

The "General Standards for Engineering Education Accreditation" specifies 12 graduation requirements, which include engineering knowledge, problem analysis, design/development of

solutions, research, use of modern tools, engineering and society, environment and sustainable development, professional ethics, individual and teamwork, communication, project management, and lifelong learning [6,7]. The fulfillment of these graduation requirements is specifically implemented in course teaching. In 2019, the Optoelectronic Information Science and Engineering program at our college was recognized as a first-class program in Chongqing. The "Frontiers of Optoelectronic Information" course is one of the courses participating in engineering education accreditation and is a practical compulsory course for undergraduates in this program.

The most important role of this course is to help students understand the frontier knowledge in related fields of the discipline, grasp the latest research trends, and effectively enhance their understanding of the theoretical and technological developments at the forefront of the profession. This enables students to quickly acquire the professional skills urgently needed in the industry, meeting the demand for technical talent in society.

Therefore, guided by the OBE educational philosophy, the "Frontiers of Optoelectronic Information" course undertakes teaching reform exploration by reconstructing teaching objectives, optimizing course content, exploring student-centered and outcome-oriented teaching activity models, and reforming the outcome evaluation system. This is done on the basis of constructing a framework that meets the graduation requirements of the general standards for engineering education accreditation.

2. Current State of Teaching

The course "Frontiers in Optoelectronic Information Lectures," a practical compulsory course for undergraduates majoring in Optoelectronic Information Science and Engineering, aims to help students understand the cutting-edge developments in the field and master the latest technologies. However, the course currently faces multiple challenges in its actual teaching practice.

2.1. Outdated Content and Disconnection from Industry Development

Optoelectronic information technology is a rapidly evolving field, encompassing areas such as optical communication, optoelectronic devices, and laser technology. Due to the untimely updating of course content, students' knowledge lags in practical applications, while new theories and technologies continuously emerge in the industry. This disconnection not only affects students' knowledge base but also weakens their competitiveness in the job market.

2.2. Abstract and Broad Content

The optoelectronic information discipline requires students to have a solid theoretical foundation and a broad knowledge base. However, the course attempts to cover a wide range of frontier areas within limited class hours, resulting in content that is overly abstract and broad. Students find it difficult to digest and understand these complex concepts in a short time, leading to poor learning outcomes and diminished interest and motivation.

2.3. Lack of Specialized Textbooks and Unified Standards

Courses in the optoelectronic information discipline often require systematic textbooks for guidance. However, the "Frontiers in Optoelectronic Information Lectures" lacks specialized textbooks and unified teaching standards, leading to inconsistencies in the depth and breadth of course content as instructors teach independently. This affects the coherence and quality of teaching, resulting in some practices that are unsuitable or impractical.

2.4. Difficulty in Integrating Ideological and Political Education

While the optoelectronic information discipline emphasizes the cultivation of technical skills, social responsibility and humanistic qualities are equally important for students. The integration of ideological and political education is particularly challenging due to the highly specialized nature of the course content. A pressing issue is how to cultivate students' social responsibility and professional ethics while teaching professional knowledge.

2.5. Time Constraints and Content Selection

As a practical compulsory course, the class hours are relatively limited (16 hours), unlike other courses where content can be covered comprehensively and thoroughly. Instructors need to make content selections within the limited time, which may lead to the omission of important frontier knowledge points, affecting students' comprehensive learning.

In summary, the "Frontiers in Optoelectronic Information Lectures" course faces numerous issues in terms of teaching content, textbook standards, integration of ideological and political education, and class hour arrangements. These issues not only impact the teaching effectiveness of the course but also hinder students' comprehensive development in the optoelectronic information field. Therefore, systematic teaching reforms to address these issues and enhance the course quality and student learning experience are urgently needed.

3. Reform Ideas and Solutions

3.1. Reconstruction of Course Teaching Objectives

Before participating in engineering education accreditation, the teaching objectives of the "Frontiers in Optoelectronic Information Lectures" course were primarily determined by the instructors drafting the syllabus based on their understanding, without unified standards and requirements. After participating in the accreditation, it is necessary to align with the 12 graduation requirements outlined in the general standards for engineering education accreditation and conduct targeted teaching work in the construction of teaching objectives. For the Optoelectronic Information Science and Engineering program undergoing accreditation, the course objectives should be clarified based on the characteristics of the "Frontiers in Optoelectronic Information Lectures": to understand the latest research methods and technologies in various research directions of the discipline; to follow the latest developments and absorb the latest theoretical research achievements in these directions; to master basic communication knowledge and skills; to broaden academic horizons, cultivate innovative spirit, inspire research ideas, and enhance research and application capabilities, while possessing self-learning abilities. Additionally, according to the development and professional positioning of the university, a course teaching system should be constructed to decompose indicator points, enabling the course to support 2-3 of these points.

3.2. Reform of Course Content

Currently, there is no textbook for the "Frontiers in Optoelectronic Information Lectures" course in the Optoelectronic Information Science and Engineering program, and thus no corresponding teaching content is available for reference. The course content urgently needs reform.

The course teaching is based on the OBE (Outcome-Based Education) teaching philosophy, shifting from knowledge transmission to capability cultivation, and from teacher-centered to student-centered approaches. The main content of the course reform includes: 1) Focusing on new technologies and methods in the industry, updating content in a timely manner, continuously exploring the latest theoretical knowledge, technological applications, and fundamental conceptual issues in industry development, and integrating this information into

the teaching system; 2) Organizing students to visit relevant enterprises and laboratories for on-site observation and practical teaching, guiding them to pay attention to industry development hotspots; 3) For students with strong interest and research potential, arranging further systematic guidance from relevant teachers and project-based practical training to deepen their understanding of the application of cutting-edge technology; 4) Organically integrating ideological and political content into the entire teaching process, such as the application and development of laser technology and fiber optic sensing in national defense, healthcare, and environmental protection, to enhance professional pride and industry mission.

3.3. Exploration of Teaching Activity Models

The "Frontiers in Optoelectronic Information Lectures" course requires mastery of the latest development directions, research methods, and technologies in the field, while having limited class hours. It is proposed to adopt a thematic lecture format, with the teaching team consisting of renowned experts and scholars in the professional field and industry professionals.

The OBE philosophy emphasizes "student-centered" and "outcome-oriented" approaches, where "outcomes" refer to the abilities students acquire after completing the course, including learning ability, analytical and summarization skills, communication and collaboration skills, presentation skills, and innovation and entrepreneurship abilities. These are combined with the indicator points of the graduation requirements for engineering education accreditation. Therefore, we explore the following teaching activity models: 1) Adopting "leading" and "experiential" teaching methods to help students understand the intrinsic relationship between disciplinary knowledge and cutting-edge technology, master methods for researching and analyzing problems, and guide them to think and explore frontier technology issues in the course; 2) In addition to lectures, using online teaching platforms like "Rain Classroom" and "Learning Pass" to upload relevant electronic teaching materials, allowing students to download these materials for pre-class preparation and post-class review; 3) Introducing exploratory and discussion-based learning content, organizing students into groups for active classroom discussions, and providing research-oriented academic papers related to the discipline for pre-class preparation, enabling students to summarize and conclude the technical background and knowledge points in the papers; 4) Adding voting, surveys, and other interactive elements to enhance classroom interaction and engagement.

3.4. Optimization of the Grading System

Under the OBE philosophy, the focus is on students' progress and ability acquisition, rather than solely on exam scores. The true implementation of the OBE philosophy is reflected in the engineering education accreditation process. The achievement of graduation requirements is calculated based on the attainment of course teaching objectives, so the calculation model for attainment should be considered in the grading system. During the engineering education accreditation process, it is necessary to redesign the assessment methods and establish a diversified, up-to-date comprehensive evaluation mechanism for student performance, without making it overly complex and difficult to assess.

Therefore, the assessment for the "Frontiers in Optoelectronic Information Lectures" course will primarily use comprehensive, open-ended stage reports, combined with classroom interaction, questioning, and completion of thought questions, with detailed, assessable, and measurable scoring standards provided. The specific attainment settings are shown in Table 1. The stage report is completed for each thematic lecture, recording basic information (name, time, topic, etc.), main content, application examples, development trends, and personal insights, with the entire design shown in Table 2 (formatted on one A4 page, with students allowed to add pages as needed).

Table 1. Achievement of the "Frontiers in Optoelectronic Information Lectures" Course

No.	Course Objective	Corresponding Indicator Point	Evaluation Basis		Grade Proportion
			Stage Report	Class Discussion	
1	Objective 1	Indicator Point 10.1	Course 1(20%)	Report 5%	25%
2	Objective 2	Indicator Point 10.1	Course 2(20%)	Report 5%	25%
3	Objective 3	Indicator Point 10.2	Course 3(20%)	Report 5%	25%
4	Objective 4	Indicator Point 12.2	Course 4(20%)	Report 5%	25%
Total			80%	20%	100%

Table 2. Course Report Design for "Frontiers in Optoelectronic Information Lectures"

Name: Student ID: Class:
Lecture Time: Lecture Venue: Lecture Topic:

I. Main Content of the Special Lecture (50%)
II. An Application Example and Development Trend (Closely Related to the Topic) (30%)
III. Personal Insights (20%)

4. Summary

Through a systematic reform of the "Frontiers in Optoelectronic Information Lectures", we aim to align with the requirements of engineering education accreditation, guided by the OBE (Outcome-Based Education) philosophy, to comprehensively enhance the teaching quality and student learning experience. By restructuring course objectives, optimizing course content, exploring innovative teaching activity models, and refining the grading evaluation system, we hope to address issues such as outdated course content, lack of standardized textbooks, and difficulties in integrating ideological and political education. This reform not only effectively promotes students' comprehensive development in the field of optoelectronic information but also provides a solid foundation for cultivating high-quality technical talents who meet societal needs. In the future, we will continue to monitor industry trends and educational developments, continuously improving course design to ensure students remain competitive in a rapidly changing technological environment.

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