

Exploring the English-Medium Instructional Model for Electrical Engineering Programs Targeted at "Belt and Road" International Students in China

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Abstract. With the continuous advancement of the "Belt and Road" initiative, the number of international students in China has been increasing year by year. To meet the growing learning needs, it is of significant importance to explore and summarize the fully English-medium instructional model tailored to "Belt and Road" international students. This study focuses on the English-medium course teaching model for the Electrical Engineering and Automation major. Through reforms such as curriculum restructuring, the establishment of a team of English-medium instructors, and the extension of practical courses through university-industry collaborations, certain teaching achievements have been made. These measures have not only enhanced the learning outcomes of international students but also provided valuable experiences for the internationalization development of universities.

1. Introduction

In recent years, with the deepening and development of China's "Belt and Road" initiative, the international status of China has become increasingly prominent, and the internationalization of higher education has been emphasized [1-4]. International student education is an important manifestation of higher education internationalization and a crucial means of enhancing international competitiveness [5-6]. According to statistics, the total number of international students in China exceeded 500,000 in June 2018, with a growth rate of over 10% for three consecutive years [7-8]. Therefore, the "Belt and Road" initiative has not only strengthened cooperation between China and countries along the route, but also promoted regional educational cooperation and development, injecting new vitality into the nation's medium- to long-term strategic planning [9]. To meet the rapidly growing demand for international student education, the practical exploration of education models for students from "Belt and Road" countries holds significant practical significance [10].

In this context, the Electrical Engineering and Automation program of Shandong Technology and Business University (SDTBU) began admitting students from "Belt and Road" countries in 2019, making it one of the early institutions in Shandong Province to offer education to international students in this field. For programs aimed at Chinese students, teachers can deliver courses in either Chinese or bilingual modes. However, international student education requires instructors not only to be proficient in their subject matter and capable of

delivering complex theoretical content in an accessible manner, but also to teach the subject entirely in English. Furthermore, there are challenges related to the cross-cultural communication abilities of instructors. Taking the example of the 2019 cohort of international students in Electrical Engineering program, all the 14 of them were from South Asian countries along the "Belt and Road" route, and most of them practiced Islam. They had differences in cultural customs, religious beliefs, and daily life and study habits compared to Chinese students. In terms of language, although these international students were generally proficient in English, they often had strong regional accents. These differences inevitably meant that teaching methods, resources, and experiences accumulated by instructors over the years could not be easily applied, posing multi-level and multi-dimensional challenges for international student education exploration.

2. Analysis of Curriculum Development

2.1. Investigation and Analysis of Electrical Engineering Programs

In order to develop a suitable educational program for international students, the curriculum teaching team conducted research on electrical engineering programs at domestic and international renowned universities. Through on-site visits, email exchanges, telephone communications, and various other methods, the teaching team engaged in exchanges and learning with the electrical engineering departments of key domestic and

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international institutions. They conducted in-depth research on the status of full English-language electrical engineering courses at domestic and international universities and gained insights into the content, scheduling, and teaching methods of professional courses at renowned international electrical engineering institutions.

Simultaneously, the team also initiated discussions and research with domestic key universities regarding the development of full English-language electrical engineering programs. They investigated the overall situation of curriculum development, teaching effectiveness, and evaluation methods. Through extensive exchanges and learning from domestic and international universities, the team gained a systematic understanding of the current status, development directions, and strategies for offering electrical engineering courses entirely in English for electrical engineering majors.

The research revealed significant differences between the curriculum and program designs for electrical engineering majors at domestic and international universities. Specifically, domestic universities tend to focus on teaching courses related to electrical engineering and power electronics, while international universities provide more specialized and research-oriented curriculum options. Students at international universities have the flexibility to choose courses based on their research interests and career goals. Therefore, when developing educational programs for international students in electrical engineering, the team adhered to local characteristics. They based the program on the Chinese-language curriculum designed for domestic students in the field of electrical engineering and selectively incorporated elements from top international universities' course structures and high-quality courses.

2.2.Comparative Analysis of Domestic and International Electrical Engineering Textbooks

The research findings indicate significant differences between domestic and international textbooks for electrical engineering [11]. Domestic textbooks tend to be concise, delve deeply into theoretical explanations, and emphasize theoretical aspects. The associated exercises are relatively complex and prioritize theoretical understanding. In contrast, international textbooks typically offer more comprehensive content, focus on practical issues, and incorporate exercises that are more closely tied to real-world problems. It's important to note that the courses entirely in English is not merely a matter of substituting "English textbooks plus English instruction" for "Chinese textbooks plus Chinese instruction."

In this context, the curriculum development team conducted a comparative analysis of the emphasis of domestic and international textbooks. They referred to classic Chinese and English textbooks and supplementary materials that have undergone multiple editions both domestically and internationally. These materials served as reference textbooks. Additionally, the team integrated practical experiences from the "Belt and Road" regions

that international students are familiar with. They also incorporated cutting-edge knowledge from the field of electrical engineering in China, as well as from developed countries in Europe and North America.

This approach aims to provide international students with a broader academic perspective and a strong knowledge base. It prepares them for their future careers and research endeavors by offering a well-rounded foundation in electrical engineering that combines theory and practical applications.

3.Reform Measures

In order to better achieve the educational goals for international students studying electrical engineering courses in China, the curriculum team continuously summarizes experiences in teaching practice. They actively collect and analyze feedback from international students and consistently optimize the full English-medium teaching and practical aspects throughout the entire course. The reforms for electrical engineering programs targeted at international students from "Belt and Road" countries primarily focus on the following three areas:

3.1.Strengthening the Development of English-Medium Teaching Faculty and Enhancing Professional and Cross-Cultural Teaching Abilities

In the wave of globalization in higher education, English has become an essential medium for international communication. However, one of the biggest challenges in the teaching process for international students is teacher proficiency in spoken English. In full English-medium instruction, many instructors are familiar with writing academic papers in English, but they may encounter difficulties in oral communication, especially when teaching international students from "Belt and Road" countries. For these students, English is often their second language, and although they may be proficient, they may have strong accents, which can pose challenges for instructors. Senior teachers with extensive teaching experience and teaching resources may struggle with spoken English proficiency, whereas newly appointed young teachers may have fluent English-speaking skills but lack teaching experience.

To address this challenge, the school proposed a cooperative teaching model that combines experienced and younger teachers. In this model, younger teachers with strong English-speaking skills act as the primary frontline teaching force in the classroom, engaging in more interactive and in-depth communication with international students. Experienced teachers, although less proficient in spoken English, contribute to curriculum design, teaching methods, and practical guidance in the course development. Additionally, considering the heavy teaching workload and preparation pressures for instructors of international students, the school aims to have two or more teachers jointly responsible for each course whenever possible. This approach not only

effectively reduces the preparation burden on teachers but also improves teaching effectiveness.

For example, in the course "Frontiers in Electrical Engineering," which comprises 16 class hours, multiple instructors collaborate, with each focusing on specific subject areas aligned with their research expertise. This collaborative model not only enriches the course content but also deepens the learning experience for international students, enabling them to understand the latest developments in the field of electrical engineering more comprehensively and diversely.

On the other hand, to cultivate a more international perspective among the faculty, the school has formulated a series of medium and long-term strategies. Firstly, the institution has established an International Faculty Exchange Program, inviting outstanding foreign educators to participate in teaching and lecturing activities on campus, enriching the international outlook of the teaching team. Secondly, through regular international faculty training programs, the school provides specialized training to help instructors enhance their abilities in delivering full English-medium instruction and engaging in cross-cultural teaching.

Furthermore, collaborations with foreign universities have been established to promote international exchanges among faculty members. The school has developed relevant systems and incentive mechanisms to reward staffs who excel in internationalized teaching, thereby encouraging more educators to participate in international education initiatives. Through interdisciplinary cooperation, the institution encourages staffs from different fields to work together, creating a more comprehensive internationalized teaching experience.

In summary, these strategies collectively contribute to the development of an internationally qualified faculty for international students. They further enhance the quality of education and raise the internationalization level of the school as a whole.

3.2.Strengthening International Student Foundations and Enhancing Multidirectional Interaction

In comparison to Chinese students, international students often have relatively weaker foundations, particularly in subjects like mathematics. To address this characteristic, the curriculum development team has carefully analyzed and summarized fundamental issues in the teaching process. These issues are prioritized based on their frequency of occurrence, and the course materials and lecture notes are gradually improved and supplemented accordingly. Basic knowledge is integrated with the professional content in the form of images, text, videos, and other multimedia elements within the teaching materials. This facilitates post-class understanding and reference for international students. Prior to course lectures, related course materials and lecture notes are made available on communication platforms for international students to preview. In class, targeted questions are raised for discussion. Instructors use specific lecture notes to solidify foundational knowledge in a clear

and accessible manner, ensuring that every international student can keep up with their major studies.

In terms of classroom interaction, international students are actively engaged in the learning process. When they have questions or uncertainties, they readily interrupt the teacher's lecture to initiate discussions with the instructor and classmates. The course team encourages this behavior and actively assists international students in clarifying any doubts they may have during class. This approach enhances the motivation of international students in their professional studies. Furthermore, the curriculum development team has introduced the "student-centered, multidirectional interaction" teaching principle. Firstly, recognizing that international students tend to enjoy practical and hands-on learning experiences, diverse assessment methods have been implemented to encourage their independent learning abilities. Group projects and practical experiment reports are considered essential components of assessing international students' overall capabilities. Secondly, interdisciplinary cooperation courses provide international students with multiple academic perspectives. During this process, the curriculum development team establishes communication channels such as WeChat groups, QQ groups, and public email addresses to ensure that international students can raise questions and seek solutions at any time, promoting a strong sense of participation and achievement in their learning journey. These strategies not only align with teaching principles but also provide robust support for the comprehensive development and academic achievements of international students.

4. Curriculum Achievements

The curriculum development and practice for electrical engineering programs aimed at international students have achieved significant teaching outcomes, meeting the expected educational objectives. Firstly, the proactive engagement of international students in the classroom has greatly improved, and they actively participate in group collaborations. Secondly, end-of-semester exam assessments have demonstrated a substantial improvement in international students' professional competencies. Thirdly, in terms of practical experiences, international students have actively participated in experiments, practical training, and course design, along with actively writing experiment reports and reflections. They have summarized their experimental experiences and lessons learned, and all students have achieved grades of B or higher in the practical assessments.

The full English-medium instructional model has received widespread external acclaim and recognition from international students. For example, international student Arabia Hossian published an English article in China Daily, sharing her life as a student at our university and expressing her love for the school and China [12]. In student competitions, under the guidance of professional instructors, international students actively engage in research activities in their respective fields. They have achieved excellent results in competitions such as the Kyoto University Student International Entrepreneurship

Competition, the iCAN University Student Innovation and Entrepreneurship Competition, and the Shandong Province Internet of Things Creativity Competition. Particularly notable is the fact that our international students won the first prize at the 2020 National University Business Elite Challenge Innovation and Entrepreneurship Competition. In terms of further academic pursuits, international students in the Electrical Engineering program have also achieved outstanding results. One international student was awarded the title of "Outstanding International Student in Shandong Province for the 2021-2022 Academic Year." Furthermore, international students are encouraged to pursue further studies, with a 50% admission rate to graduate programs. Among them, over 20% of international students have been admitted to first-class universities such as Zhejiang University, Southeast University, and Xi'an Jiaotong University.

These achievements highlight the effectiveness of the curriculum development and the positive impact on international students' academic and professional growth.

5. Conclusion

This study, through the innovative reform of the full English-medium instruction model for international students majoring in electrical engineering who come to China under the "Belt and Road" initiative, has demonstrated the positive impact of this English-medium instruction model on the learning outcomes of international students. The outcomes of this research are not only significant for enhancing the professional competence of international students but also provide valuable insights for the internationalization of higher education in China.

However, there are still some challenges to address in the full English-medium instruction process. This requires collaboration among universities, teachers, and students to continuously optimize teaching strategies and promote the ongoing development of full English-medium instruction in electrical engineering programs. Through persistent efforts, we can provide international students under the "Belt and Road" initiative with a higher-quality educational experience and cultivate more internationally competitive electrical engineering professionals.

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