

# Application of an immersion teaching model to electrical power engineering

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**ABSTRACT:** Due to the many problems experienced during teaching *electrical power engineering*, the author devised a *permeability education model* using guidance and introduced a novel set of teaching. This article describes this model and provides an elaboration of the current status of the development of the course based on this model. Course related experiments were redesigned based on the existing teaching content, as well as a new teaching environment was developed. Also, a new comprehensive evaluation system was introduced. The evaluation results show that the permeability bilingual teaching mode achieved a better teaching outcome for the experimental group of students than for the control group students.

## INTRODUCTION

Application of an immersion teaching model to electrical power engineering teaching refers mainly to the implementation of a bilingual teaching model [1].

Bilingual teaching is a new teaching model and many colleges and universities are exploring its application or are implementing it in teaching practice. Under this teaching model, English replaces Chinese as the main medium of instruction and, in the process, English learning is permeated into the specialised courses [2].

With the deepening of globalisation and informationalisation, modern intellectuals should not only be expert in a certain field, but should also be proficient in the English language. Taking into account the above, it is advisable for teachers to properly adopt English teaching in *Electrical Power Engineering*, so as to better stimulate students' enthusiasm for learning the subjects and the English language. The immersion teaching mode exhibits a distribution teaching approach, in which professional terminology involved in electrical power engineering to every course can be distributed and dispensed.

In this way, though students are immersed in limited terminology, the most important is that they are exposed to the English teaching environment every day and the vocabulary of technological terminology acquired by them will constantly grow, and often unwittingly. In addition, their English language sense and English communication level can also be upgraded. Eventually, they will achieve a substantial leap based on the quantitative accumulation of terminology and professional jargon.

Currently, Chinese universities and colleges have reformed many courses and specifically those for electronic information engineering majors. However, they find themselves in a dilemma during their exploration of bilingual teaching practices [3]. The dilemma is mainly reflected in terms of professional knowledge and English terminology. Though a favourable English learning atmosphere is created, if teachers adopt all-English teaching in electrical power engineering, students might have difficulty in understanding what teachers are talking about at the beginning. As a result, they might passively listen to the course and fail to follow the course of teaching progress. The present course construction has paid too much attention to meeting industry demands.

Many excellent course construction frameworks, which feature the combination of production, teaching and research, have been established. The teaching model under the guideline of producing high quality engineers has greatly enriched the teaching process, but the above successful practical experiences have failed to catch up with the requirement for cultivation of the talent required with the acceleration of global informationalisation [4].

As the newly-established electrical power engineering system enterprises and the electrical departments of other industries develop rapidly, lots of state-of-the-art sophisticated equipment has been introduced, and more and more international scientific research achievements have broadened the Chinese vision. All these have indicated that bilingual compound talents are needed [5]. Therefore, it is necessary to reform the teaching of electrical power engineering through the immersion teaching model, so as to cultivate more sophisticated and high-quality international talent.

Many graduates majoring in electrical power engineering have become good engineers in the electrical power and electrical engineering field. However, an excellent engineer should not only master electrical power and electrical engineering knowledge, but should also have a good understanding of the latest development trends in the international arena. This requires relevant graduates to master basic professional English [6]. However, currently only few colleges and universities in China have been applying the immersion teaching model to electrical power engineering. As a result, students tend to lack the knowledge of professional English.

Electrical power engineering is one of the main required courses for majors related to electrical power and electrical engineering [7]. The adoption of the immersion teaching model can improve students' awareness of learning English and comprehensive English proficiency, on the one hand, and stimulate students' enthusiasm and increases the teaching efficiency and quality, on the other.

At the same time, the course under the immersion teaching model still follows the Chinese textbooks, so it can expand students' knowledge of English terminology through the acquisition of the relevant professional terminology existent in the Chinese language. Teachers should endeavour to ensure that students absorb as much English terminology as possible in the course of study. During the immersion process, students can accumulate English terminology and broaden their international vision based on their own interest.

## EXPERIMENTAL OBJECTS AND METHODS

In the experiment, there were 180 students majoring in electrical power engineering at a university, randomly chosen as research subjects, of which 115 were male and 65 were female students. Named Class 1-3 (90 students) as the experimental group and Class 4-6 (90 students) as the control group. Electrical power engineering was taught under the bilingual immersion teaching model with the experimental group and according to the traditional teaching model with the control group.

The experiment continued for one semester. The teaching hours of every semester was 24 hours (equal to 32 credit hours) under the immersion teaching model. The credit hours were equal to the teaching hours under the traditional teaching model.

## EXPERIMENTAL TEACHING MODEL

The teaching model was designed according to three core parts based on the reflection of the rigid unilateral language model of the traditional teaching model as follows:

*Teaching methods:* the immersion teaching model does not mean all-English teaching and integrative bilingual teaching in the strict sense. It adopts the Chinese textbook to assist teachers in making their partial English teaching plan. Under the requirement of ensuring the teaching progress, it aims to continuously expand university students' knowledge of professional terminology. As to the experimental group, to master the English terminology was the priority. Since the terminology of some specialised courses are mixed with the commonly-used phrases, teachers can lead students to think before they introduce the English terminology.

For example, how is the terminology translated into English? Teachers should interpret the constitutional meaning of specific terminology as best as possible. In this way, students can accurately understand the English expressions and use them. Even though they might make some mistakes, they will have a deep impression of the terminology acquired. Through the immersion teaching model, students keep the key English terminology in mind instead of memorising them through the so-called *spoon-feeding* education.

China's traditional education has made passive learning a normal routine. This has limited university students' development in the free university learning environment. Students might have poor initiative to learn and fail to live up to the goal of university education. However, under the immersion teaching model, teachers consciously immerse the students in professional terminology and paragraphs repeatedly in the teaching of the course to fully stimulate students' initiative to learn. As through the bilingual immersion learning, students can be exposed to professional English. In this English learning environment, students' knowledge of professional terminology will be increased consistently. The group discussion in the bilingual course can also increase students' fluency in English, and significantly improve their communication skills.

*Teaching environment:* since electrical power engineering is a highly practical course, a course, which combines the knowledge of relevant theory, hardware and software, teachers should be flexible and change their bilingual teaching

mode, especially, in terms of some hardware knowledge, like principles, concepts and descriptions, by interpreting such knowledge in the Chinese language, so as to ensure that students genuinely understand what the teachers are talking about, thus, avoiding misunderstanding and misconception.

Teachers should also endeavour to develop required courseware according to students' practical situation. They can add flash animations and English videos and audios to the courseware to enliven the bilingual class atmosphere. In a relaxed learning atmosphere, students can enjoy learning the seemingly complex terminology. On the other hand, most specialised courses at universities feature the small-class teaching model; whereby, teachers can arrange the seats more flexibly so as to create a bilingual academic group where students can freely air their own views.

*Teaching content:* the class hours are equal to those of the traditional teaching model. While compiling bilingual textbooks, teachers should mark the key terms in the book and make multimedia PPTs. The bilingual immersion textbook should have chapters arranged according to the order of the Chinese textbook. After giving notes related to the key vocabularies, teachers should introduce the latest development trends, especially, the scientific research achievements, both in China and abroad, and give a brief introduction of the relevant research institutes.

On the completion of every unit, teachers should show the independent research achievements and academic papers of the relevant experts and scholars in a bilingual way so as to stimulate students' learning interest, guide them to find the field they are interested in and lay a solid foundation for their future career, advanced specialised courses and overseas study. The immersion teaching process is shown in Figure 1.

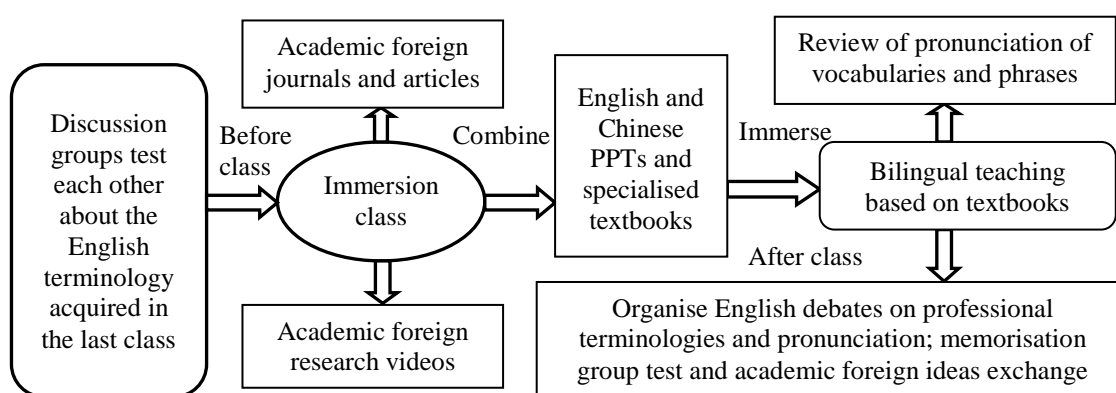


Figure 1: The immersion teaching process.

## EVALUATION METHODS

After experiencing years of test-oriented education, many university students are afraid of the evaluation systems. The assessment system of the traditional teaching model through marking cannot objectively evaluate students' comprehensive abilities. Assigning scores should not be the only standard to test students' knowledge. Otherwise, students might learn for the sake of obtaining satisfactory scores, but ignore the cultivation of other, often critical abilities.

Therefore, innovative evaluation indexes and new approaches should be adopted to replace the traditional evaluation model and compare the advantages and disadvantages of the two models. On the one hand, the evaluation focuses on the goal of cultivating professional elites; on the other hand, the evaluation should accommodate the course nature of electrical power engineering. Thus, the evaluation indexes and methods can be designed in the following way.

*Basic professional knowledge (Index 1):* an excellent electrical engineering student must possess a basic professional knowledge. Closed-book examinations are still necessary. Two of such examinations can be arranged for both semesters; namely, the mid-term one and the final one. Each should account for 50 points. Students' final scores are the amalgamation of the two.

*Professional English listening and speaking ability (Index 2):* in order to cultivate international talent with all-around development, it is necessary to test students' ability to express professional ideas in English. Students should be familiar with the key words, terms, phrases or even paragraphs of the academic field. They should not only understand them, but should also express and interpret them. Listening and speaking ability can efficiently test whether students have fully mastered the English vocabulary.

*Independent thinking and creativity (Index 3):* teachers should organise group discussions on a frequent basis. These should lead them to conclusions on the progress of the students. Students may also take the initiative to organise debates and literature review after class. All these and other extramural activities can test students' independent thinking ability and their creativity based on the knowledge acquired. The evaluation index accounts for 100 points.

## RESULTS AND ANALYSIS

After every semester comes to an end, teachers can mark students' performance according to the above three evaluation indexes and conduct a comprehensive evaluation through the BP neural network based on the maximum entropy error criterion. The overall experimental results are shown in Table 1.

Table 1: Comparison of the overall experimental results.

| Group  | Index 1 | Index 2 | Index 3 | Comprehensive scores |
|--|---------|---------|---------|----------------------|
| Control group                                | 67.50   | 74.00   | 68.26   | 69.92                |
| Experimental group                           | 75.25   | 82.00   | 80.14   | 79.13                |
| Improvement proportion of experimental group | 11.48%  | 10.81%  | 17.40%  | 13.17%               |

It is obvious from data in Table 1 that the various result indicators of the experimental group for which permeability bilingual teaching mode was adopted are superior to those of the control group for which the traditional teaching method was adopted. Professional basic knowledge mastery degree and the score of the experimental group was 11.48% higher when compared with the control group.

As for English listening and speaking competence, the score of experimental group reached 82, 10.81% higher when compared with the control group. With regard to professional basic knowledge and independent thinking ability, bilingual teaching mode is much higher than traditional mode. The score of experimental group was 17.4% higher.

## CONCLUSIONS

According to the above data analysis, the degree of mastery of professional basic knowledge in the experimental group is obviously superior to that in the control group. This fully explains the fact that there are considerable differences between the two different teaching modes. The permeability bilingual teaching mode can help students understand and remember professional knowledge more vividly and deeply. Through the analysis of the three leading indicators, the experimental results fully demonstrate that the teaching effect of the permeability bilingual teaching mode is superior to the traditional teaching method. It can be seen from the control group's data that students in both the experimental group and the control group can deal with the examination for professional basic knowledge.

Based on data analysis, the author was able to confirm that the advantages of the bilingual penetration mode are much more than the disadvantages in terms of students' professional English knowledge and solid professional theoretical learning. Permeability bilingual teaching not just makes the classroom become a real learning environment, but also extends a real learning interest to pre-class and after-class activities. Under the new teaching process system, before class, group members ask questions, which arouse students' competition awareness and improves students' memory.

Through face-to-face interviews between teachers and students after the examination, it was learnt that the students in the control group generally considered the examination to be difficult. Even if they kept all the basic knowledge in their mind, they were unable to tackle some open questions in the test paper and could not really comprehend the key points of professional knowledge. Meanwhile, they could not flexibly apply the knowledge to answer questions. The students in the experimental group expressed their view that the brilliant classroom atmosphere and intense discussions, as well as teachers' guidance in the classroom made them familiar with relevant concepts and principles, informed them about current research in this area and research literature, and they could flexibly apply what they had learned. So, they could well adapt to the examination.

In this bilingual teaching mode, the students in the experimental group used a gradual penetration teaching mode. They mastered specialised vocabulary mainly through comprehension, so that their memory was more vivid and profound. On the contrary, the students in the control group mechanically memorised specialised vocabulary, so it was very hard for them to apply the vocabulary skilfully. Even with cramming before the examination, the students in the control group would not be familiar with the vocabulary.

The new teaching method relies on the guidance by the teachers, group discussion, interactions between teachers and students, supply of the latest international cutting-edge information on subject of their study. Thus, students' learning interest in such a professional course is fully stimulated. In the classroom, students gradually start to take the initiative to think over problems, propose questions and organise discussion. Finally, they gradually solve problems independently in this professional course.

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