The Application of Flipped Class in Electrical Engineering Professional English

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Abstract—In view of the problems existing in the teaching of Electrical Engineering Professional English and the characteristics of this course, a three-stage teaching model of Electrical Engineering Professional English is proposed in this paper, namely “Adaptation-Formation-Improvement” (AFI). This model aims to solve the two major obstacles of syntax and reading comprehension in professional English learning. Teaching practice shows that AFI teaching model can not only stimulate students' interest in learning professional English, cultivate their self-study ability and teamwork spirits, but also effectively improve their proficiency in reading professional literatures in English as well as professional English learning skills. AFI has certain practical significance for English teaching of electrical engineering specialty.

Keywords—Electrical Engineering; Professional English; Applied Undergraduate; Teaching Model; Flipped Class

I. INTRODUCTION

Electrical Engineering Professional English (EEPE) is neither a language course nor a professional course, but a course that combines the two organically. It is a course in which students can read English original scientific and technological literature, books and technical manuals smoothly with the help of professional dictionaries, improve their reading and translation abilities, and remove the obstacles of scientific and technological language [1]. With the development of global economic integration and internationalization, the international exchange of Electrical Engineering professionals is getting closer and closer, and the criteria for the ability of using professional English is getting higher and higher for Electrical Engineering professionals. Therefore, English or bilingual courses for electrical engineering specialty have been offered in most colleges and universities, and active exploration and research [2,3,4,5] have been carried out on teaching models, teaching methods, and bilingual teaching. Based on the characteristics of application-oriented undergraduate education and the problems existing in the teaching of EEPE, this paper puts forward a three-stage teaching model of electrical engineering, namely, Adaptation-Formation-Improvement (AFI), which combines the characteristics of Electrical Engineering English. The main contents of this paper include: the problems existing in teaching of EEPE, the characteristics of EEPE, the design of AFI teaching model and conclusion.

II. PROBLEMS IN THE TEACHING OF EEPE

There are many problems in English teaching for Electrical Engineering specialty, such as lack of excellent textbooks, poor faculty, single and outdated teaching model, students' negative learning attitude and so on. The main problem is still the teaching model. The traditional teaching method is still "teacher's speaking and student's listening". The students are the passive recipients of knowledge. The lack of proper communication and interaction between teachers and students results in students' lack of interest in learning professional English. On the one hand, the teaching model of EEPE is different from that of College English. College English pays attention to the explanation of vocabulary, grammar and syntax, but it is not specific to the field of Electrical Engineering. EEPE not only involves a large number of professional vocabulary, but also grasps the skills and characteristics of English and Chinese in the translation of scientific and technological sentences, which lays a foundation for students to engage in graduation design and future work. Therefore, in teaching, we should not simply follow the teaching model of College English, nor simply interpret the course as an English-Chinese translation. On the other hand, students often do not realize the importance of learning professional English, lack interest in learning. They think that professional English is hardly used in work anyway. They learn professional English purely for the purpose of passing examinations and getting credits. Their motivation and pressure in learning are low nor are their initiative and enthusiasm. This kind of learning attitude will inevitably lead to the ineffective in class teaching. In fact, there is a close relationship between students' learning attitude and single teaching model. In order to fundamentally change students' understanding of professional English learning and stimulate students' interest in learning, besides strengthening the importance of professional English education, the reform of teaching methods and teaching models is the key to solve the problems.

III. CHARACTERISTICS OF EEPE

Compared with College English, EEPE has obvious features, such as more passive voices, frequent use of complex long sentences, and a large number of nominalized structures [1], which all bring difficulties to the understanding and translation of the original text. Complex long sentences are frequently used. In order to fully, concisely and accurately
express the internal relationship of things, professional English needs to use a large number of long sentences, which often contain several clauses and non-predicate verb phrases, and these clauses and phrases often restrict and depend on each other, thus forming a complex phenomenon of clauses with phrases and clauses in phrases. The function of long sentences is just adapted to the stylistic needs of ESST (English Style for Science and Technology). In addition, long sentences also involve the skills of literal and free translation. There are many passive voices. The object of scientific and technological English narration is often things, phenomena and processes, which emphasizes the narrative itself rather than its subject. Passive voice has the pragmatic function of emphasizing the patient and putting it in the topic and thematic position. It can not only highlight the center, but also attract the attention of readers. The most prominent feature of professional English in syntax is that the number of passive voices can account for more than one-third to half of all predicate verbs. A large number of nominalized structures. For example: “The rotation of the earth on its own axis causes the change from day to night.” The nominalized structures (the rotation of the earth on its own axis) simplifies compound sentences into simple sentences and makes the concepts expressed more precise and precise. In addition, the other features of professional English include the extensive use of non-predicate forms (gerund, participle, verb infinitive), scientific and technological English vocabulary (commonly used vocabulary specialization, multi-specialization of the meaning of the same word, extensive use of word-formation), and lexical features such as its tendency to nominalize. In summary, if students want to learn EEPE well, they should have a good grasp of the characteristics of EEPE. Only by grasping the characteristics can we express the original meaning completely and accurately and avoid ambiguity.

To sum up, based on the characteristics of application-oriented undergraduate education and the problems existing in the teaching of EEPE, this paper proposes an AFI teaching model of EEPE. This model aims to solve two major obstacles in professional English learning: professional English syntax and professional English reading. Professional English syntax is to introduce a large number of long sentences of typical grammar, seek rules, accurately understand the meaning of the original text and avoid ambiguity; Professional English reading is to guide students to apply the mastered typical syntax to professional English textbooks and literatures, accurately and smoothly reflect the original, improve reading skills and translation skills.

IV. DESIGN OF AFI TEACHING MODEL

The core of AFI teaching model is to take the grammatical analysis of long sentences, multiple sentences and compound sentences as examples to solve the problems of reading and understanding of long sentences; to improve students' ability of reading and translating EEPE by translating the original text; to cultivate students' reading abilities, translation skills and team work abilities by using the teaching method of flipped class as the main part and teaching as the assisted part, thus improving students' awareness and initiative in learning English for Electrical Engineering major.

A. Adaptation

As a university for nationalities, students' English foundation is uneven, which brings difficulties to teaching, so the adaptation stage is necessary. The adaptation stage mainly teaches students basic reading and translation skills, especially the flexible use of literal and free translation. The adaptation stage (8 hours) is mainly consisted of in-class teaching. Combined with teaching the characteristics of electrical engineering English by PPT and the textbook [1], the course serves as a reading guidance for students. The course content emphasizes on passive voice, complex long sentences, nominalized structures, non-predicate forms, professional vocabulary and lexical features. Typical examples such as long sentences and compound sentences are given in order to help students seek reading and translation formulas and improve students' reading ability and translation skills.

B. Formation

In formation stage, the teaching form of flipped class is adopted, and the specific teaching design is as follows.

- Divide students into groups. Five-students group (standard class 50 students, a total of 10 groups), free combination, each group set up a group leader, responsible for the group members in inclass and afterclass study.
- Students are seated in each group in order to facilitate interactive learning and classroom discipline management.
- To adopt the teaching method of combining teacher's guidance with student's presentations of given topics. Teachers provide the topics to each group in advance (the topics are based on the textbook). The topics are allocated randomly to students for fairness.
- Under the leadership of the group leader, each group previews (professional vocabulary, long sentence understanding and translation) and prepares PPT in advance. In each class, one group (represented by one group member) gives a 30-minute presentation (the rest of the group can supplement appropriately), translating the original English textbook content under the given topic. Presentations should be smooth and stick to the original text and professional terminologies, meanwhile conforming to Chinese grammar and Chinese habits.
- After the presentation, the class enters Q&A session. Questions can come from the teacher and a group of students appointed by the teacher. The raised questions should have a certain depth (for example, combining with the professional knowledge learned, whether a word is understood accurately, whether a long sentence is understood and translated accurately, whether it conforms to the meaning expressed in the original text or the professional knowledge learned). The questioning part will be taken into account of participation grade.
At the end of the interactive session, the teacher makes a final comment mainly on the mastery of syntax, the understanding of sentences and the mastery of professional knowledge. The formation ability stage should be 20 hours (2 hours for each flipped group). Through this stage of learning, students can deeply understand the characteristics of EEPE, master the reading and translation skills, and form a solid foundation for learning ability.

Flow Chart of teaching design for EEPE flipped class shown in Fig.1.

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C. Improvement

The improvement stage (6 hours) are mainly for self-study and group interaction. Teachers recommend two professional English literatures published in foreign core journals in recent years for students to further improve their ability to reading ability of academic literals, and lay the foundation for capstone design. Two papers were assigned: (1) Robust adaptive control for a single-machine infinite-bus power system with an SVC. (2) Multiple-input Maximum Power Point Tracking algorithm for solar panels with reduced sensing circuitry for portable applications. Obviously, these two papers are more difficult for undergraduates because there are many theories and methods that students have not learned or even heard of such as classical non-linear control methods (back-stepping, direct feedback linearization) and modern non-linear control methods (Robust control, immersion and invariance control). Two papers also cover the knowledge of flexible AC transmission systems (FACTS), static var compensation devices (SVC), Photovoltaic technology, Maximum Power Point Trackers (MPPTs), Perturb and Observe method and other modern power systems and new energy sources. Although they are challenging topics, they serve as an actual practice that can truly test the learning effect of the first two stages.

The requirement for students in this stage is to read and understand professional literature quickly, to understand the academic frontier trends, and to provide reference for capstone design topic selection and capstone thesis writing. Learning is carried out in groups. Under the leadership of the group leader, relevant materials are consulted, relevant theories and methods are understood, and learning reports are written. During class, each group interacts, exchanges and displays the learning results. Teachers comment on each group according to the discussion quality.

D. Assessment

EEPE is a mandatory course. The assessment is divided into participation and final examination. Final exam accounts for 60% and participation account for 40%. The examination content basically covers the learning content of the flipped class, which not only improves the students' attention to the flipped class, but also facilitates the students to focus on reviewing. The AFI teaching model provides teachers with a good reference for the quantification of students’ afterclass study. Participation grade is designed to emphasize on the level of students’ active learning, active participation in class and teamwork ability. Participation grade is divided into three evaluation indicators: attendance, presentation and discussion. Among them, attendance accounts for 10%, presentation accounts for 20%, discussion accounts for 10%. The evaluation of the flipped class includes PPT + presentation + Q&A session (each group gives feedback in class, teachers collect them as a reference for the final grade). The final grade is based on overall performance of the group and will be the same across group members. Assessment for EEPE is shown in the table I.

**TABLE I. ASSESSMENT FOR EEPE**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>10%</td>
</tr>
<tr>
<td>Presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Discussion*</td>
<td>10%</td>
</tr>
<tr>
<td>Examination</td>
<td>60%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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*Discussion: Discussion marks are awarded to students to reflect their level of participation in group discussions, posing questions, concisely answering questions, contribution to ongoing discussion and other activities.

Stages in AFI model are interrelated and interlinked, which can not only stimulate students' interest in learning professional English, change passive learning of knowledge to active acquisition of knowledge, but also effectively improve students' practical ability of reading professional English literatures and writing English abstracts. More importantly, through this teaching model, students can master the methods and skills of learning professional English. In their future work, when they face an imported electrical equipment or an English contract or order, they can operate smoothly and respond easily, and truly become a high-quality applied electrical engineering talents with strong social adaptability and competitiveness.
V. CONCLUSION

Aiming at the problems existing in English teaching for Electrical Engineering specialty and combining with the characteristics of English for Electrical Engineering specialty, this paper puts forward a three-stage teaching model (AFI) of English for Electrical Engineering specialty. The AFI teaching model adheres to the problem-oriented approach, aiming at improving students' professional English reading ability. The teaching is easy to implement, highly operable and has a reasonable evaluation system. It is a useful exploration for the teaching of EEPE.

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REFERENCES


