

Reform and Practice of Professional English Teaching of Physics in Universities

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Abstract—In view of the common problems existing in the teaching of English for science and engineering majors in terms of curriculum content and teaching methods, this paper takes physics as an example, makes a study and beneficial attempt on the teaching reform from the perspective of practicability, and provides a more specific teaching reference scheme for classroom teachers. The above exploration also has reference significance and popularization value for other professional English teaching.

Keywords—professional English teaching of physics, reform and practice, content of courses, teaching method, EST

I. INTRODUCTION

Professional English is scientific and technological English based on general English and with professional knowledge as its content. It is charged with the task of promoting students to complete the transition from learning stage to using stage, and training students not only to read various English professional documents smoothly, but also to communicate in English academically. In recent years, with the deepening and development of quality education reform, the acceleration of knowledge updating and the increasing frequency of international exchanges, more and more scientists and technicians hope to learn advanced foreign theories and technologies through professional English as a tool [1]. For this reason, professional English has become a compulsory course for most science and engineering majors in universities.

As a special cross-disciplinary course between English and physics, Physics Professional English has the following characteristics: 1) there are many vocabularies in physics, and in the scientific and technological articles of physics specialty, and students often encounter many verbose professional words that are difficult to spell, understand, such as dia-magnetism, synchrotron, antineutrino, etc. 2) Literary rhetoric is less. Science and technology articles for physics majors should focus on facts and logic, and their style should be clear, strict, standardized and objective. 3) Sentences are long and compact. 4) The passive voice is widely used. Compared with ordinary English, the passive voice is widely used in science and technology articles for physics majors because of describing objective phenomena.

II. GENERAL PROBLEMS IN ENGLISH TEACHING FOR PHYSICS MAJORS

Physics is the basic subject of studying material structure and motion law. Its object of study is the most extensive and the law of study is the most basic. It is the important foundation of modern technology. It advocates rationality and attaches importance to logical reasoning. The above characteristics of Physics determine the wide range of its professional English teaching content and the diversity of teaching purposes, that is, we should not only cultivate students' professional knowledge and logical thinking, but also improve their application ability of EST (English for science and technology) [2]. However, from the current teaching practice of colleges and universities, professional English teaching in this direction is still in the blind zone, and there are generally the following problems: 1) The course content is obsolete, the number of textbooks is small, and because of the long years, they can not keep up with the new development and achievements of physics. 2) In the design of teaching methods, too much attention is still paid to simply imparting knowledge, so that students lose their main position in teaching and lose interests in professional English learning. 3) There is little time in class to provide students with opportunities to listen, speak, translate, write and think, so that they can not adapt to the needs and challenges of the times. 4) Institutions or students do not attach enough importance to professional English, which is classified as a dispensable supplementary course, like selective reading of professional articles, tutoring and answering courses. These key problems also exist in the teaching of professional English in other majors, which make teachers' teaching activities have no reliable basis and foothold.

In order to solve the above problems, many colleges and universities have carried out reforms and explorations in professional English teaching in recent years, and have achieved certain results and experience [3-4]. But when it comes to representative disciplines such as physics, there are few studies in this field. In view of the above problems, this paper discusses the teaching contents, teaching methods and means of English for Physics Major in order to provide practical solutions for teachers' classroom teaching. Today, the development of modern science has its own comprehensive characteristics, that is, knowledge, methods and ideas of various disciplines permeate each

other, and science and engineering have their own commonalities. The study of any major can not be simply attributed to the content of a major. Therefore, the above discussion on the professional English of the representative subject of physics should also have certain reference significance and popularization value for the teaching of other specialties in science and engineering.

III. REFORM AND DESIGN OF TEACHING CONTENT

In the reform and design of teaching content, we should change the method of simply inculcating knowledge according to the trend and demand of science and technology of the times. Generally speaking, the fields of physics can be divided into four areas: condensed matter physics; atomic and molecular physics and optical physics; high energy and particle physics; Astrophysics and cosmology. Therefore, on the basis of full investigation and based on the Nobel Prize in Physics (including some Chemical Prizes) over the years, the teaching content can be divided into the above four modules. Through content modularization, students can be better introduced to the current research fields and the latest developments in physical direction within a limited period of educational time. By decomposing the dull physical knowledge into the research work related to the Nobel Prize in Physics, students can not only master the basic professional knowledge and vocabulary, but also greatly expand their knowledge of physics and understand the research contents in the relevant fields of physics.

Professional English education should pay attention to practicality, and the teachers should always focus on practicality. This will not only stimulate students' learning motivation, but also enable them to receive proper training in listening, speaking, writing and translating after learning professional English courses, so that they can play an important role in their respective professional fields in the future. Therefore, it should be the main direction of the reform of professional English curriculum content that how to combine the basic professional knowledge in physics-related fields with the development of modern physics and related frontier scientific and technological knowledge in order to stimulate students' interest and motivate them to study actively. With teaching practice and opinion feedback in recent years, following are the revised and gradually finalized teaching contents of the author's professional English teaching team, which can be the reference for readers and peers.

A. Lectures in the Field of Physics

In this part, the relevant knowledge in various fields of physics is selected, which embodies the characteristics of close to teaching practice and rich in pictures, so as to facilitate teachers' teaching reference and students' learning. Examples include: Nobel Prize in Physics, Quantum Theory and Atomic Models, Semiconductor Physics, Superconductor, Nanotechnology, Plasma Physics, Laser, etc. In the actual teaching, each chapter is supplemented by

"vocabulary of physical science and technology", "key points of knowledge" and "extracurricular thinking and expansion" so as to enable students to consolidate their knowledge, expand their thinking and horizons. Of course, in specific teaching, teachers can flexibly arrange teaching content according to their specialty and scientific research situation. However, we should pay attention to the novelty and richness of the content. With the background of various professional fields of modern physics, we should focus on the training objectives of students in science and related fields. We not only pay attention to basic knowledge, but also keep abreast of the rapid changes of new achievements and new technologies in physics, taking into account the systematicness, practicability and operability of content as much as possible.

In the early 19th century, William von Humboldt, founder of Berlin University in Germany, put forward the educational thought of "teaching through research" and "unification of teaching and research". Qian Wei-Chang, a famous scientist and educator in China, once said: "Universities must dismantle the high wall between teaching and scientific research. Teaching without scientific research is an education without viewpoint and soul." Therefore, as a teacher of higher education, teachers should not only be satisfied with the imparting of the traditional knowledge, but also integrate their own scientific research into classroom teaching, so as to promote the improvement of teaching effect and quality. In the research work, the author has been focusing on computational condensed matter and material physics for a long time, and recently designed various molecular device simulations based on low-dimensional carbon-based materials. Based on this, the author introduced the fullerene molecule in detail and the author's own research on fullerene molecular devices in the classroom. This not only broadens the students' horizons of knowledge, but also makes them feel that scientific research is not mysterious and always around them.

B. Practical English Skills Training

This is a special design for developing students' ability to use scientific and technological English. Specific contents can include expressions of common symbols and formulas in mathematics and physics, common grammar in EST, EST translation, EST writing, and academic exchanges in English, etc. In my opinion, the expressions of symbols and formulas commonly used in mathematics and science, and the grammar commonly used in EST can be parallel with the lectures in the field of physics in the first part, so that students can understand the relatively boring grammar through vivid and concrete examples in the text. After these explanations including EST translation, students can be assigned to read after class, translate some typical passages into Chinese, and discuss them in class to analyze and correct students' misunderstanding or errors. For the teaching of scientific English writing and English academic exchange, we should pay attention to the flexibility and diversity of teaching methods in order to

encourage students to open themselves up and participate bravely.

C. Extracurricular Part

Some relatively simple English journal papers or Nobel Prize-winning speeches can be arranged for students in their spare time to improve their understanding. This will not only improve students' professional level, but also broaden their horizons, so that their ideas can be not confined to their own small positions in the professional field, which will lay a certain foundation for future cross-disciplinary research and cooperation. For example, in order to cultivate students' ability to read English documents independently, the author divided the students into groups of 5 to 6 persons each. According to the teaching schedule, the author arranged relevant English documents for each group and asked the students to read carefully and take notes. At the end of each chapter, class discussions were arranged specially for each group to send representatives to report and answer questions. After practice, students generally reflect well.

IV. REFORM AND DESIGN OF TEACHING METHOD

To stimulate students' classroom initiative and improve teaching quality and efficiency, it is necessary to design and adopt scientific and reasonable teaching methods and means in combination with curriculum content. Constructivist learning theory emphasizes "knowledge construction". It holds that learning is not the process of teachers' knowledge transfer to students, but the process of students' knowledge and ability construction [5]. Students should be in a central position and teachers should be the facilitators of learning. Therefore, teachers should change their concepts, change the traditional "teaching-oriented" model and replace it with the "student-centered" model of interaction. Teachers also should regard students as equal subjects, guide them to participate actively in the teaching process, stimulate their consciousness, initiative and creativity, and strengthen their attention to professional English learning. In addition, students should be given enough time and space to make full use of their brains to experience and discover questions in a relaxed and pleasant atmosphere.

Specifically speaking, in order to change students' passive learning into active learning in professional English teaching, students should first have a clear understanding of their professional English level, especially their practical application level, so as to stimulate their desire to improve themselves. How can we do this? College students are important carriers and disseminators of modern scientific and technological knowledge. They have a strong sense of subject and a strong desire to acquire new knowledge and skills of the times, so that they can be recognized by others and themselves. Teachers can follow the above psychology of contemporary college students. First, they can ask questions in class according to the teaching content in Part B in Section III, and require students to answer in English.

Generally speaking, at first, students are afraid to answer questions because they worry about being laughed at by others. In response to this situation, teachers can first outline the content of this lesson, inspire students to ask questions in English about topics of interest like new physical terms or strange physical phenomena, and ask teachers or other students to explain. At the same time, teachers should pay attention to the transmission of a point of view to students that there is no good or bad question, in order to encourage students to ask boldly. Asking and answering questions is a very good communication process. After this practical training, the students' enthusiasm should be significantly improved, and they will be fully aware of their obvious shortcomings in all aspects of professional English, so as to stimulate the desire to make up for the improvement.

At the beginning of the above process, students will feel very nervous. However, with the course going on and the continuous communication and repetition of questions and answers, students' shyness will gradually disappear and their desire for expression will continue to increase. When most students are getting better and more relaxed in class, they should have a feeling of eagerness to use professional English. At this time, teachers can provide them with opportunities to exercise, such as writing a professional English paper and giving academic lectures or reports. Students need to actively consult literature, collect data and organize text in the process of writing papers. After submitting papers, students also need to produce PPT files, give a lecture at the end of the course for ten minutes, and answer questions from teachers and students for five minutes. Students can be appropriately evaluated and encouraged after giving speeches and answering questions. In the whole process, students gradually change from shyness and embarrassment to actively answering questions and playing freely, and they will not only experience the pleasure of active application of English, but also improve their ability to understand and use professional English. In teaching, teachers should also pay attention to helping some students with poor spoken English in time so that they can get rid of the embarrassing situation and continuously improve their self-confidence and interest in learning.

On the other hand, the reform of the above-mentioned teaching methods should be supplemented by the change of the way of curriculum assessment. In the traditional way of assessment, it is generally divided into two parts: the usual performance and the final performance. In order to mobilize students' enthusiasm for learning more effectively and to broaden students' knowledge more vigorously, the author added some new assessment content on the basis of the traditional assessment model, like requesting students to write a small paper of not less than 1000 words in English and giving reports in English. For example, after the chapter on "nanotechnology", the teacher asked the students to write a short paper on two-dimensional materials other than graphene by consulting the literature. For small papers like this, teachers will arrange about 10 papers in a semester and students can choose one of them to complete.

This kind of examination not only exercises the students' ability to read documents, but also trains the students' ability to write papers.

V. REQUIREMENTS OF TEACHING REFORM ON TEACHERS' ABILITY

In order to achieve the above goals of teaching reform of professional English, teachers should also improve the quality of themselves. Professional quality is an inevitable requirement for teachers to do a good job in professional English teaching, and teachers should have the following abilities:

A. *New Knowledge Acquisition Capability*

Professional English takes on the task of instructing students to read English books, periodicals and documents related to the major, so that students can further improve their ability to read English scientific and technological materials, and can use English as a tool to obtain the information needed by the major. As a professional English teacher, he must have the ability to update his knowledge structure, supplement his academic nutrition and broaden his educational horizon at any time, and strive to have a brand-new scientific connotation and humanistic essence. Physics English involves all directions and fields of physics, therefore teachers themselves should have better be professional and knowledgeable in order to guide students to study. Only in this way can teachers take on the teaching task of professional English.

B. *Classroom Control Ability*

Professional English teaching requires teachers to have good classroom control ability. In the classroom, teachers should encourage students' personality development, excavate students' potential, cultivate students' innovative ability, and also improve students' interest and enthusiasm. The key is classroom control ability. Classroom teaching is the main channel of education. Whether a teacher can control the classroom determines the success or failure of education. In professional English classroom teaching, we should pay attention to two extreme ways, so as to grasp the dominant position of students and not ignore the leading role of teachers. Without teacher-led classroom, it is a free and scattered classroom, while without the main role of learning, the classroom again returns to the stereotype of test-oriented education.

C. *Multimedia Teaching Ability*

Professional English learning is dull and tedious. The memory of professional vocabulary is a headache for students. Teachers can use multimedia to change dull textbooks into visual feasts, so that students can be bright and actively involved in learning. This requires teachers to have the ability to retrieve information and acquire knowledge, as well as the proficiency of multimedia teaching operation. A teacher who does not use modern teaching methods is difficult to be a competent teacher.

Modern college students are used to getting information and entertainment from a variety of media, such as rich internet or colorful movies. They are no longer satisfied with the monochromatic color of black-and-white in the classroom. Teachers should find out and master this general psychology of students. In addition to using conventional means such as multimedia animation and demonstration, teachers can also introduce some healthy and relevant film clips relevant to the teaching contents. These auxiliary methods will make students learn easily and make them impressed and memorable about what they have learned [6].

VI. SUMMARY

From the above discussion, it can be seen that on the basis of a correct understanding of the characteristics of the course Physics Professional English, teachers can improve the teaching quality from many aspects. However, with the continuous development of science and technology, every research field is also updated at any time, so teachers must keep up with the latest development of the curriculum, and strive to improve their academic and teaching level, in order to keep pace with the development of the times.

It is a complex system engineering to transfer the teaching of professional English course to the educational track of effective use. It involves the formulation of curriculum plan and syllabus, the compilation of textbooks and the teaching practice of teachers. This transformation can only be realized if it is recognized by all aspects of University teachers. There are the specific problems not only of textbooks, but also of examination system, school conditions and teachers' level. We should also take into account the enormous teaching inertia. Therefore, the reform of professional English teaching is a relatively long-term task, and our educators have a long way to go.

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