Exploration of Bilingual Educational Mode for Instrumental Analysis and Experiments Guided by Scientific Research

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Keywords: Talent training; Instrumental analysis and experiments; Bilingual teaching.

Abstract. The bilingual course on "Instrumental analysis and experiments" is a professional education course for students with the major of chemical engineering. It involves the spectral analysis, relative molecular mass and its distribution measurement, spectrum analysis and electrochemical analysis and other related content. The theoretical knowledge is rich and requires students to do practicing at the same time. This paper analyzes the characteristics of the bilingual course of "Instrumental analysis and experiments" and the necessity of bilingual teaching, and further proposes the bilingual teaching strategy to further broaden students international perspectives, enhance students' ability to use foreign languages to acquire instrumental analysis of cutting-edge knowledge, and their ability to learn independently and comprehensively, and improve the effectiveness of classroom teaching and the level of internationalization of the curriculum.

Introduction

At present, when solving practical analytical chemistry problems, the proportion of instrumental analysis methods is increasing. At the same time instrumental analysis courses have become the main basic courses for chemistry, environmental science, biology, and medical related majors in universities. Rapid development (many knowledge and skills are internationally advanced) and difficulty (relevant knowledge and technology are mostly presented in English and other foreign languages), resulting in low teaching efficiency and poor learning effect in the traditional teaching mode. How to change this status quo is one of the issues to be urgently addressed in education and teaching. Bilingual teaching can enable students to get in touch with professional foreign languages and foreign advanced knowledge and technology as early as possible, which is conducive to learning advanced foreign teaching methods and concepts. As far as the teaching status of Instrument Analysis and Experiments is concerned, bilingual teaching that combines online teaching and offline teaching modes can be adopted, which can improve teachers' teaching efficiency and student learning effects, while cultivating students to follow the international frontier and participation, and integrate into international competition. The main content of the bilingual course "Instrument Analysis and Experiments" is to learn various instrument analysis methods, the principles of the instrument, the basic composition of the instrument, and the test operation method, etc., which run through the university learning stage of the undergraduate students, including various courses, experimental lessons, graduation thesis (design), comprehensive experiments, college students' innovation and entrepreneurship training programs, etc. These are the basic skills that students must master. After many years of undergraduate teaching practice, on the background of first-class discipline construction, starting from the chemical engineering specialty, self-experience and further explorations are proposed on the reform and construction of the bilingual course of "Instrument Analysis and Experiments."

The Necessity of Bilingual Teaching of Instrumental Analysis and Experiments

"Instrument Analysis and Experiments" includes two types of courses: theory and experiments. The development of bilingual teaching is great significance in both theory and experiments. The bilingual teaching of theoretical courses can improve students' professional knowledge and
professional English at the same time, and conducive to the training of international talents. This course is for juniors. The vast majority of students have passed the Level 4 English exam, some students have passed the Level 6 exam and have completed the study of Professional English. However, students generally have insufficient mastery and familiarity with professional English and vocabulary, and cannot use professional English vocabulary quickly and flexibly to learn professional knowledge. This course effectively connects professional foreign languages and professional knowledge, and expresses a variety of research methods of instrument analysis in English. The use of full English PPT and English teaching in the theoretical course links allows students to have high-density and high-intensity exposure to professional vocabulary during effective classroom time.

Combining the students' own professional knowledge, the bilingual teaching of this theoretical course enables students to effectively master the basic knowledge involved in materials research methods, familiarize themselves with the English expressions of various knowledge points in the first time, and improve the students' professional English cognitive ability and energy-saving training of international talents.

The bilingual teaching in the experimental class not only enables students to digest and absorb theoretical courses, but also strengthens students' further understanding of professional knowledge and the application of professional English in the course of practice, which is conducive to the cultivation of high-quality innovative talents. The experimental lessons of this course focus on the use of common instruments involved in the analysis field, including sample preparation techniques, test procedures, spectrum analysis, and data processing.

The bilingual teaching of the experimental class allows students to quickly become familiar with the English operation interface of the instrument and equipment, understand the English vocabulary of various parameters involved in the sample characterization, and allow students to intuitively understand the knowledge points of the theoretical class during the actual operation. Master various research methods of analytical instruments, further inspire students to explore the relationship between material structure and performance, stimulate students' interest in studying samples from shape, structure and performance, and cultivate students' scientific thinking and innovative thinking.

Reform of Teaching Methods and Means for Bilingual Course of Instrumental Analysis and Experiments

Fully Prepare for the Course

In order to successfully complete bilingual teaching, the optimization of English textbooks and reference materials has become the top priority of teaching preparation. Combined with the Chinese textbooks selected for this course, referring to the original English textbooks and course materials used by foreign universities, organize and improve the course lectures and multimedia courseware, retain the classic content in English textbooks, delete more esoteric theoretical derivations and non-important knowledge points, adapt to undergraduate teaching to the greatest extent, and truly achieve "student-oriented." In addition, the production of multimedia courseware also greatly affects the learning effect of students. After repeated deliberation and practical teaching, adjusting the graphic and text ratio and appropriately increasing the animation not only intuitively expresses more complex knowledge points, but also can improve students' interest in learning.

Rationalize the Curriculum

The theory course and the experimental course are interspersed in the teaching process, enabling students to practice immediately after learning the basic knowledge of the theory, not only consolidating the theoretical learning content, but also strengthening the accumulation of professional vocabulary.

At the same time, the important and difficult points in theoretical learning will also be reflected through the study of experimental classes. Teachers can add supplementary explanations to ensure
that students have knowledge of important and difficult points, and solve problems exposed by students due to incomplete knowledge.

Try not to leave questions after class.

**Diversified Teaching Methods**

The adjustment of teaching methods needs to be arranged according to the course content, using group learning methods and case-driven teaching that students can fully understand the learning content through group discussion. In addition, group teaching can dilute individual consciousness, weaken students' resistance to teacher authority, give full play to students' initiative to learn independently, and stimulate students' learning potential to the greatest extent.

Students can fully express their opinions in group learning, and the existing questions will be resolved through secondary learning and repeated discussions to deepen students' understanding and enhance classroom learning effects. At the same time, regular reading and reporting of English literature is necessary. The analysis of the spectrum or data in the literature helps students to digest and absorb the knowledge they have learned, and allows them to experience the application of Instrumental Analysis and Experiments in scientific research. Make teaching and learning more clear, which is conducive to students' further education and employment in the future.

**Introduce "Online Courses" Mixed Teaching Mode**

Establish Instrument Analysis and Experiments online courses, upload MOOC videos, exercises, and voice pre-learning lessons. Push them to students' mobile phones to facilitate timely communication between teachers and students. Using this platform, the professional English vocabulary used in the bilingual course is pushed to students before class, allowing students to use their spare time to translate them which effectively preventing students from not understanding professional vocabulary that affect learning focus in the classroom. In addition, the "online courses" platform can be used in theory classes to receive student feedback on course content in real time. Then adjust the teaching progress and teaching rhythm, and give timely repeated explanations or appropriate translations to the places that students do not understand, so that the teaching process is visible and controllable. Publishing instrument operation videos, steps and precautions on the platform can shorten the time for teachers to demonstrate experiments and improve the teaching efficiency of teachers in the experimental class. Place and grade assignments on the "online courses" platform. Track the learning of each student at any time, obtain quantitative students' learning data which can better guide teaching.

**Conclusion**

The construction of the bilingual teaching course of Instrumental Analysis and Experiments is significance to promote the coordinated development of students' knowledge, ability and quality, which to promote the integration of China's higher education with international standards. The reform of bilingual curriculum system and optimization of teaching content is a long-term and systematic project. In order to achieve satisfactory bilingual teaching results, we must strengthen learning and utilization in the teaching process, continuously improve the curriculum content, and cater to the development trend of the discipline.

**References**


