English Language Teaching; Vol. 18, No. 5; 2025
ISSN 1916-4742 E-ISSN 1916-4750
Published by Canadian Center of Science and Education

A Longitudinal Study on an EAP Course for MTI Students: *Introduction to Engineering Knowledge and Its Translation*

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Received: April 7, 2025 Accepted: April 27, 2025 Online Published: April 28, 2025

doi: 10.5539/elt.v18n5p45 URL: https://doi.org/10.5539/elt.v18n5p45

Abstract

With the development of international exchanges and globalization, there is an increasing need for translators and interpreters. Language students of translation majors usually lack scientific or technical knowledge. This paper introduces an innovative EAP (English for Academic Purposes) course—*Introduction to Engineering Knowledge and Its Translation* to students of Master of Translation and Interpreting (MTI) at a top university in China. The course is innovative in terms of teaching objectives, content of learning, pedagogy and aims to introduce fundamental knowledge as well as core vocabulary in four major engineering fields (Electronic and Telecommunication Technology, Mechanical & Electrical Engineering, Civil Engineering, and Materials Science & Engineering) to enable students to read specialized articles, perform engineering English-Chinese and Chinese-English translation engineering. The paper mainly focuses on this EAP course's design and the improvement of the teaching effectiveness, which has implications for other EAP course designs. Course development can be divided into two stages: 2017-2020; 2021-now. TPCK (Technological Pedagogical Content Knowledge) is adopted in stage 1 and 2; POA (Production-Oriented Approach) approach is adopted in stage 2 to improve the teaching effectiveness. Surveys are conducted to get students' feedback for improvement and students' evaluation to the course obtained from the school's teaching website shows that students' satisfaction to the course increases over the years. Analysis of the students' translation indicates the usefulness of POA in enhancing students' competence of engineering translation and the course assessment shows the accomplishment of the teaching objectives.

Keywords: EAP course design, MTI, translation, engineering knowledge, pedagogy, EAP lecturer

1. Introduction

Nowadays there is an increasing need for EAP courses domestically and internationally. English teaching and researching aims to serve social and technological development, and therefore its objectives are also determined and adjusted by social development. EAP has always been a challenge to EAP teachers. Some scholars studied the English for academic purpose and academic literacy principles in teaching writing (Wingate and Tribble, 2012). As EAP teaching and research is growing rapidly around the world, the EAP practitioner's role and identity is becoming a key issue (Ding & Bruce, 2017). Hamp-Lyons (2001) pointed out early that most EAP teachers are not aware of the complexities and potential problems at the early stages of teaching. Some study argued that that the lecturer's stance in face of the content is that of an inquiring student (Kirschner & Wexler, 2002). EAP lecturers need to seek professional development and keep learning knowledge constantly about teaching pedagogy, educational technology and especially the integration of these aspects to develop "appropriate, context-specific strategies and representations" (Mishra & Koehler, 2006). Some researchers call for higher education institutions to realize that the development of language training programs for staff is a key prerequisite for maintaining standards and assuring the quality of EMI (Drljača Margič and Vodopija-Krstanovič, 2018). However, the practice and teaching effectiveness of EMI courses still needs to be explored.

The mid-term and long-term educational reform and development goal of China is to establish a humanistic and quality-oriented education as a strategic focus and speed up building world-class high-level universities. The goal of our university, a national first-tier university, is to educate students into excellent personnel with innovative competence, broad horizons, and international competitiveness and global governance to participate in international affairs.

Cai (2017) argues that the teaching guidelines and curriculum of College English in China need to be reformed in order to meet the needs of social and technological development. English teaching should not be denied its function as a tool besides the humanistic goal. English teaching should aim to teach and cultivate students' English competence for specific or academic purposes, especially academic reading and writing abilities with critical and scientific insight to meet the needs of their specialized studies.

English majors have also encountered a crisis which has received criticism in that graduates are not competitive in the job market without having subject-specific knowledge. Cai (2018) argues that the solution to the crisis is to have a scientific disciplinary planning of the English majors to strengthen disciplinary knowledge learning and also teach compound subject knowledge to meet the needs of new technology, new agriculture, and new medicine development as a national strategy and requirement of higher education. He suggests setting up a new discipline of ESP (English for Specific Purposes) to educate students into inter-disciplinary talents. He differentiates English instruction of content learning from ESP learning; the latter aims to enable students to learn about how knowledge of some specific subjects is constructed and communicated in terms of genre, discourse structure, rhetorical devices and language expression. This paper will focus on the former, EMI or EAP, teaching subject content knowledge through English.

Since the founding of the MTI degree granted by the Chinese Academic Degree Committee of the State Council in 2007, the MTI education is provided in more than 350 universities currently in China. Liu (2019) studied 236 papers published during 2007 and 2019 on MTI and found that Translation teaching modes and teaching Sci-Tech translation are among the research focuses. Li (2017) surveyed six universities in Dalian of China, and revealed some common problems: the teaching of translation is simplified as mere language conversion rather than a discussion on the translation strategy at discoursal level or the functionality of translation; classes are usually teacher-centered where students are passive receivers of knowledge; translation materials are limited and lack practical orientation. One suggestion is to decrease the difficulty of translation tasks which contain subject knowledge. We argue that the solution of decreasing difficulty of translation cannot solve the existing problems completely. Li (2019) analyzed current problems in MTI curriculum design and gave countermeasures including systematic design and connection between undergraduate translation studies and MTI programs, necessities of setting up featured courses, professional training, machine translation modules, etc. Miao (2016) argued that science and technology universities should set up MTI programs which integrate the strengths and features of the universities. MTI education scholars (Zhong, 2020; Mu, 2020) call for setting up featured courses, training students with interdisciplinary abilities to meet social needs owing to the fact that MTI graduates are not yet seen as adequate for those jobs which demand subject knowledge.

Shi and Niu (2020) conducted a comparative study on MTI cultivation modes between Chinese and foreign universities to investigate the teaching curriculum (obtained from their websites) of 41 foreign universities and 46 Chinese universities which offer MTI education, and found that in the aspect of "other knowledge" courses Chinese universities tend to offer Chinese literature-related courses while foreign universities offer more about cross-cultural communication, law, commerce, current affairs and even European history to broaden students' horizons and scope of knowledge, including courses pertaining to science and technology, but so far no subject knowledge of engineering has been taught. The authors of this paper investigated the course modules of Translation Studies leading to master's degrees in some British universities and found that the courses mainly include translation theories and skills, genres and text types, computer-assisted translation tools and translation project management, language modules, etc., without introduction to specific subject knowledge.

Most of the MTI courses are centered around translation theories and skills, we assume that one major strategy to cope with some common and urgent problems in MTI education is to bridge the knowledge gap of students (most MTI students have liberal arts backgrounds). Our study focuses on the course design of an innovative EAP course for MTI students—Introduction to Engineering Knowledge and Its Translation. This course is innovative in terms of the teaching objectives, the syllabus design and pedagogy. It aims to teach some fundamental engineering knowledge and vocabulary to MTI students to enable them to perform translation more accurately and professionally. The teacher is more than a lecturer—a course developer, knowledge manager, facilitator, cooperative learner, and evaluator. The paper mainly introduces the needs analysis, course design, pedagogy, and analysis of the teaching effectiveness.

2. Rationale of the Course Design

2.1 EGAP vs. ESAP

In the Hutchinson and Waters' classic 1980 article, "ESP at the Crossroads", they claimed that what we should all be teaching is not the surface aspects of specialized discourse but the general linguistic competence that underlies such learning, regardless of the field of study. The Waters-Hutchinson paper laid out the main argument for wide-angle LSP (Language for Specific Purposes) (Huckin, 2003).

Hyland (2002) has argued to put specificity to ESP—a narrow-angle ESP. He argues that teaching "specific language, skills and genres of particular groups" is "time consuming and skill-intensive", but it is the most effective and professional teaching practice.

Hutchinson and Waters' wide-angle ESP and Hyland's narrow-angle ESP shed light on the distinction between EGAP (English for General Academic Purposes) and ESAP (English for Specialized Academic Purposes).

Huckin (2003) has emphasized a student-centered ESP. He claims that classroom instruction, therefore, should emphasize the teaching of strategies rather than linguistic forms, uses, and other surface aspects of communication. Huckin's student-centered ESP reveals that an EAP instructor is a mentor and facilitator who trains and helps students to become independent learners.

This EAP course is an optional course for MTI students with its content difficulty designed between EGAP and ESAP, which is more specialized than EGAP but less specialized than ESAP in the respective fields. Flowerdew (2016) states the difference between EGAP and ESAP: "While EGAP is concerned with provision of English for students from all fields of study, ESAP is focused on the needs of students from specific disciplines."

2.2 Needs Analysis

Basturkmen (2010) stated the necessity of identifying the target of an EAP course and analyzing the current knowledge state of students as well as "practicability" in order to make a teaching plan.

In the fall semester of 2017, our EAP course—Introduction to Engineering Knowledge and Its Translation was offered to MTI students at my university, which covered four fields of engineering knowledge in 32 academic hours. Needs analysis in designing the course was mainly from the director of the MTI program (the second author of this paper), who had been teaching MTI for over ten years and was aware of the knowledge gap of the students. He proposed setting up a featured course of Introduction to Engineering Knowledge and Its Translation in the Year 2016's MTI cultivation scheme and also designed the framework of the course (The course title originates from an academic lecture content of Associate Professor Zheng Shuming). Most MTI students were from Humanities and Liberal Arts disciplines with no engineering foundation, and it had become increasingly urgent and essential for the translation program to set up an EAP course to bridge this gap. Therefore, the first author of this paper designed an EAP course to include four major fields introducing fundamental knowledge as well as core vocabulary, accompanied by some practical translation exercises to cultivate students' awareness of technical translation. It features the interdisciplinary integration of translation and engineering, relying on the engineering strengths of Harbin Institute of Technology to cultivate talents in scientific and technical translation. Liu (2019) makes a list of the major subject knowledge in engineering projects: mechanical and electrical engineering, mining and metallurgy industry, petrochemical industry, chemical fiber textile industry and civil engineering. He claims that translators or interpreters of engineering cannot master subject knowledge like engineers but they can get general knowledge about the major concepts and terms in the above subjects, the English-Chinese equivalents and the main applications. Finally, we chose Electronic and Telecommunication Technology instead of Aerospace Technology for two reasons: Electronic and Telecommunication Technology is widely used in life, work and studies; we could find appropriate textbooks for it. This conformed to the principle of practical possibilities and constraints of the teaching context in needs analysis.

2.3 Principles of This EAP Course Design

Considering academic reading occupies a major part of this EAP course, principles of EAP reading course design are studied (Spector-Cohen, Kirschner & Wexler, 2001; Kirschner & Wexler, 2002; Kuzborska, 2011).

2.3.1 Principle 1: Select an EAP Teacher with Compound Knowledge Background

Select a trained EAP teacher with compound knowledge structure or subject knowledge to enable a quality EAP course which contains subject knowledge.

An EAP teacher's knowledge structure and self-learning ability have a substantial impact on both the design and the quality of EAP courses. Kuzborska (2011) studied eight EAP teachers' decision-making processes when designing an EAP reading materials in a Lithuanian university setting and found that most decision-making was

intuition-led, rather than research-led. Kuzborska's study shows that the EAP teachers' lack of subject knowledge limited their classes to focusing on vocabulary learning rather than realizing the stated goals of developing students' academic abilities, and also prevented them from cooperating with subject teachers or involving students in selecting materials. Other studies also raised the issue of EAP teacher's background and assumed lack of qualification and authority in the field of question (Kirschner, & Wexler, 2002). These findings are revealing in that EAP teachers are indeed knowledge-demanding roles and we assume that EAP teachers should have a compound knowledge structure or good self-learning ability in order to be able to teach EAP courses involving subject knowledge.

2.3.2 Principle 2: Select Content-based and Theme-related Materials to Enable MTI Students to Build up Content Knowledge and Specialized Vocabulary

In EAP courses, reading makes up the foundation of other skills. Studies show that the most effective means of teaching language learners with academic needs could be through theme-based, content-based teaching (Freeman & Freeman, 2003). Moreover, content instruction can further lead to the acquisition of reading strategies and develop critical understanding of a variety of written genres (Grabe, 2009, as cited in Kuzborska, 2011).

This course aims to build up engineering knowledge and vocabulary which is essential to the quality of translation. According to Carell (1983), there are two types of schemata: formal schemata (reader's background knowledge about the formal, rhetorical structures of texts) and content schemata (knowledge about the content area of a text).

Specton-Cohen, Kirschner, and Wexler (2001) assumed that "a possible means to alleviate the problems of not being familiar with academic content and genre is to choose texts that are linked thematically, thus developing content schemata and facilitating vocabulary re-entry". They argued that "meaning" instead of "linguistic forms" should be the primary focus of class activities and tasks. When it becomes an EAP course for translation studies in this paper, meaning is primary, and linguistic form should be secondary focus.

2.3.3 Principle 3: Include a Variety of Materials to Enable MTI Students to Build up Genre and Rhetorical Knowledge of ESAP and be Engaged in Academic Learning

As to the types of texts, introducing a variety of texts into a curriculum could be more appealing or engaging, hence motivating according to Nuttall (2005, as cited in Kuzborska, 2011). Variety can also ensure students to become familiar with the specificity of genre and language in different subjects.

Materials need to cover core concepts and terms to represent each subject. Materials should also be pertinent to the students' lives and reflect the latest technology and applications so that they can be motivated and find learning useful.

2.3.4 Principle 4: Design Academic Tasks of Oral Presentations, Reading Reports and Writing Assignments to Enable Students to be Highly Involved

EAP task design usually involves speaking and writing, such as making an oral presentation or writing a summary, which demands thorough work on the text (Shih, 1992). A writing task that permits a meaningful exploration of texts is summary (Grabe, 2009; Nuttal, 2005, as cited in Kuzborska, 2011). Academic tasks such as oral presentations have been proved to "enhance vocabulary acquisition" and "valuable for language learning" (Kirschner & Wexler, 2002).

In sum, the design of this EAP course was to enable MTI students to build up general content knowledge of some engineering fields, core specialized vocabulary, as well as genre and rhetorical knowledge of ESAP. Academic tasks of oral presentations, reading reports and translations were designed to keep students engaged. The primary goal of this EAP course was to establish a foundation of fundamental subject knowledge and vocabulary, and the secondary goal was practicing translation from English to Chinese and from Chinese to English of engineering knowledge.

2.4 Teaching Materials and Curriculum

Commercial textbooks are perceived to be of better quality than in-house texts (Kuzborska, 2011). We selected from commercial specialized English textbooks in the respective fields and adapted the use of them to meet our needs. To cope with students' lack of content knowledge and formal knowledge, the textbooks needed to be linked thematically. Criteria of selection were content-appropriate to this particular course, with courseware available, being published by renowned publishing houses. For example, ESAP textbooks about Telecommunication were available at the bookstores but we found most of them were too specialized which were not very suitable for our students. After a careful study of the textbooks, we selected some chapters from

four textbooks (Liu & Liu, 2014; Zhu &Yang, 2010; Huo & Jiang, 2010; Kuang, Wang & Gu, 2015) and made a design of the use of the materials: teaching materials, reading materials, topics for students' presentations, English-Chinese & Chinese-English translations, etc. There are also supplementary textbooks (Dunn & Howey et al., 2010; Lei & Yuan, 2010, etc.).

Considering the conflict between the limited class hours and large knowledge load, we select the most fundamental content to learn. Each field of knowledge is discussed over four weeks, with the first two weeks giving a brief introduction to the core concepts, key technologies, core vocabulary of the respective areas, and the following two weeks focusing on E-C, C-E translations as well as continued learning of field knowledge. Electronic and Telecommunication Technology introduces fundamental electronic components, equipment and technologies, e.g., mobile communication, optical fiber communication, wireless sensor networks, wireless fidelity, the Internet of Things, artificial intelligence, etc. Civil Engineering mostly includes branches of civil engineering, knowledge of structural buildings, mechanical behaviors of structural steel, bridges, solar energy in construction, etc. Mechanical and Electrical Engineering covers mechanism, machine parts, CAD/CAM/CAPP, material forming and processes, MEMS, mechatronics, industrial robots, etc. Materials Science & Engineering mainly introduces knowledge of metals and alloys, ceramics, polymers, composite materials, and nanostructured materials, etc.

3. Teaching Pedagogy

In designing the teaching pedagogy of the course, teacher's role as a mentor and specificity of content are considered. Regarding the subject-specific features of the learning content in each different discipline, Hyland (2002) argues that the discourses of the academy do not form an undifferentiated, unitary mass but a variety of subject-specific literacies. Huckin (2003) states that an EAP teacher is insufficient to provide an accurate instruction of disciplinary knowledge. Thus he recommends EAP teachers to empower students from the start and the role of EAP teachers is a mentor or a coach.

In designing the teaching pedagogy of this course, the authors also embrace TPCK which takes into account technology, pedagogy and content together, "requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content..." (Mishra & Koehler, 2006).

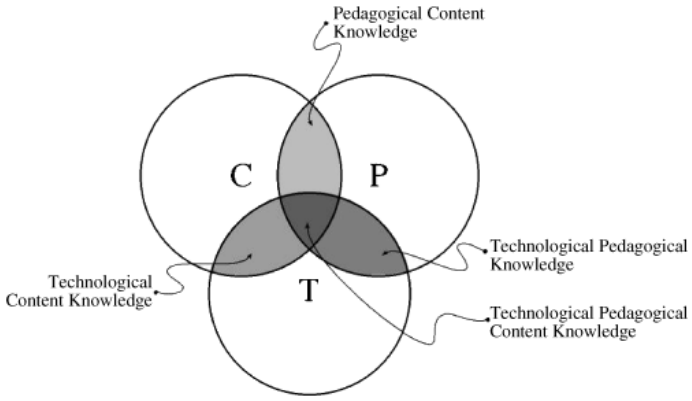

Figure 1. Pedagogical Technological Content Knowledge (Mishra & Koehler, 2006:1025)

Pictures, videos and aural materials can be effective aids to illustrate engineering concepts and applications. Pictures are helpful tools to introduce bridges, high-rise buildings, mechanical components, etc. Pedagogy may vary with different specialized fields. When teaching Telecommunication, the lecturer takes typical examples of communication and relates it to daily life application, such as mobile communication, optical fiber communication, Wi-Fi, etc. When teaching Civil Engineering, focus is on introducing the key concepts of stress and strain, elasticity and ductility, etc. which is the core concepts in structural design. When teaching Materials Sciences and Engineering, relationship between structure, properties, performance and processing is the core of understanding each type of material. Also, the lecturer can help students be aware of the fact that engineering knowledge is not isolated but interrelated across different fields. For example, the concept of ductility is taught in Civil Engineering but also applied in material forming and processes in Mechanical Engineering. The lecturer needs to have a relatively thorough learning and understanding of each field so that she/he can introduce some fundamental concepts or knowledge concisely and know about the link between knowledge nodes.

Developing the students' self-learning and critical thinking abilities are also the goals of this EAP course. The

course adopts blended approaches of task-based learning, web-enhanced inquiry learning, flipped class, etc. Knowledge construction is realized through elaborately designing meaningful academic tasks or assignments for students to accomplish—oral presentations, reading reports and translation assignments. Each student is required to make a 15-minute oral presentation on a particular topic. Reading reports include writing a summary for a reading article from the textbooks as well as five E-C sentence translations. Translation assignments consist of 8 of English-Chinese/Chinese-English translations (3 submitted for rating, 5 for practice). It should be noted that in this course, translation is not only the end-product of the course but also a means to acquire knowledge. After class, the lecturer can share some resources or links with students in the QQ or WeChat group for further learning, such as Forth Bridge, biodegradable materials, multi-hop wireless networks.

Students do translation assignments before class and take the printed assignments to class for discussion. The lecturer also asks some students to send her the electronic versions before class in turns so that she can know how well the students translate. Reading reports and translation assignments are rated by the lecturer and feedback is offered in the next class.

4. Teaching Effectiveness

4.1 Assessment

Assessment is made up of oral presentations (15%), reading reports (30%), translation assignments (30%), final term test (25%). Assessment has been modified over the years. See Table 1.

Table 1. Course Assignments and Assessment

Oral Presentations	15- minute oral presentation on an assigned topic	15%
Reading Reports	Three articles, writing a summary with 5 English-Chinese sentence translations for each	30%
Translation assignments	2 Chinese-English translations and 1 English-Chinese translation (There are 8 exercises in total, 3 for rating, 5 for practice)	30%
Final Test	Translation of 100 core specialized vocabulary from English to Chinese，paragraph translation	25%

Oral presentations, reading reports and translation assignments are all aimed to enable students to acquire engineering knowledge and vocabulary to improve engineering translation quality. Oral presentation topics are suggested by the lecturer and students are encouraged to explore the topic knowledge and present to the class. It is evaluated regarding topic content, delivery (language, non-verbal communication), visual aids and PowerPoint effect. Reading reports include a summary of the reading article and 5 sentences for English-Chinese translation. It assesses students' ability to comprehend engineering articles, to summarize main ideas and to translate accurately. Translation assignments are selected texts or exercises to cultivate students' awareness of using engineering terminology and syntactic structures. Specialized vocabulary test and paragraph translation in final test (students can not consult resources) are designed to test how well students have acquired the engineering knowledge and how well they can do engineering translation.

Paragraph translation consists of two parts: English-Chinese translation, which is extracurricular; Chinese-English translation, selected from translation assignments. Students' average scores of course assessment range between 87-93. The final test indicates that students have fostered awareness of using engineering vocabulary for translation, however, not all the students could master the engineering terminology in one semester. Forgetfulness is an issue in this course. This indicates that teaching hours could be increased or training should be strengthened to enable students to master knowledge solidly. Overall, developing the awareness of using engineering terminology and the ability to learn knowledge for accurate translation has been achieved in this course.

4.2 Surveys and Feedback

Since the course was an innovative course in 2017 which needed to be constantly improved, both the students and experts' feedback and suggestions gave us valuable information on how to improve the course and make it more effective. For example, class interactions, discussions and atmosphere are being improved to make it more interactive. Flipped class mode has been used and assign translation tasks before class so that class efficiency can be improved. Now the course has been offered for 7 years (8 rounds) and it has been being tested and improved in practice (The course of Grade 2018 and Grade 2019 were both delivered in 2019 respectively,

because the lecturer went abroad in 2018). We made several improvements in teaching methods since 2021, therefore the course development can be divided into two stages: stage 1 (2017-2020), stage 2 (2021-2024). Feedback on the course was collected from the students' evaluations of the course at the university's teaching website and also from the surveys after the course was given.

There are 81 students (80 MTI students, 1 science student) taking this course since 2017: 11 (2017), 10 (2018), 10 (2019), 10 (2020), 11 (2021), 11(2022), 11(2023), 7(2024). The students' holistic evaluation of the course obtained from the teaching website (the total score is 100 points) is positive and satisfactory towards the course design, teaching arrangements, and the teaching: 89.44 (2017), 85(2019), 86.25 (2020), 89.44 (2021), 93.89 (2022), 95 (2023), 93.33 (2024). It can be seen that the students' evaluation towards the course has improved markedly since 2021.

4.2.1 Feedback in Stage 1

The authors administered surveys to the students of Year 2018, 2019 and 2020 and obtained their feedback after the course ended. Students think "learned much engineering knowledge and vocabulary", "very helpful to improving translation abilities", "interesting"... The followings are selected from some of the students' feedback:

"Ms. Wang is very patient, prepares abundant extra-curricular materials, is very conscientious in preparing lessons, can stimulate students, has discussions with students in QQ group." (Students of the Year 2017, feedback was obtained from the school's website)

"This course is very essential for us who are lacking in engineering knowledge, and it is particularly suitable for our university which is featured with engineering. I've learned a lot of engineering knowledge concerning theories, concepts and terms."

"The course is well-designed and hope the teacher can keep up." (Students of the Year 2019)

"The course enables me to have some general knowledge of engineering. Learned some ways to search for engineering knowledge, like Wikipedia. The biggest gain is that I have overcome my phobia of engineering. With the help of dictionaries and some websites, I'll be able to cope with translations concerning engineering." (a student of the Year 2020)

One of the comments from the Year 2020 students:

"Translation assignments are the part I learn and benefit greatly from. Thanks for the teacher's conscientious correction of the translation assignments, which provided me with feedback on the quality of my translation."

As mentioned earlier, this course adopts the teaching pedagogy of multi-channel knowledge input, so translation assignments and reading reports also have the function of knowledge building. Students' reading reports show that students' reading technical English articles, writing summaries as well as translation of sentences are being improved gradually. One student (whose reading report 1 and 2 were rated 7 and improved to 9 after rewriting) commented:

"Reading reports are the part I like most. Although I need to rewrite every time, I've learned and benefited a lot." (a student of the Year 2020)

As for oral presentations, one student of the Year 2019 commented:

"My topic is ceramics. I have gained more knowledge about ceramics through this project. Initially I just studied how ceramics are made, later I got to know more and more about it — its properties and industrial applications, its classification as well as its history of development. I also learned some terminology, e.g. covalent, brittleness...I developed my speech skills."

Another student of the Year 2019 commented:

"Oral presentation is a novel activity in this course and I have many gains in preparing for my report on high-rise buildings. First, I have acquired deeper and more knowledge about this area, and I have known more channels to search for useful information and resources. Second, it helps me improve my communicative competence. Third, it's helpful for practicing translation skills."

Some of the students' presentations are so well-prepared that their PowerPoints can be used as learning resources as a result of the co-construction of the course materials, a valuable part of this course's achievement.

The following is some of the feedback and suggestion from the expert who observed the class in 2017:

"The teacher mainly gave feedback on the common problems in the translation assignments, introduced specialized knowledge and terms in Civil Engineering by audio materials, pictures and texts, and also

distinguished between confusing terms…" (Date of observation: Dec.1, 2017)

Survey results indicate that most of the students thought they learned "much" or "some" engineering knowledge and specialized vocabulary in the four fields within the limited 32 teaching hours. We find that there is a discrepancy between the students' perception of their learning achievement and our expectation. We assume there are three main factors which have affected their learning achievement: one is English delivery, second is the challenging content of the engineering knowledge, and the third is the large amount of new knowledge delivered in 32 academic hours. Most students thought the course design and the learning content reasonable but there was one student who thought the course hours should be reduced and the focus should be put on translation rather than engineering knowledge. This feedback reminds us of the necessity to introduce the course objective to the students in the first lecture so that students could have a better understanding of the course (the major objective is to teach some fundamental engineering knowledge and the secondary objective is to practice technical translation). This feedback also indicates the value of the survey— to obtain students' perception of the course design and their learning achievement. Some students thought the course content was difficult to understand if delivered in English completely and suggested introducing the main idea in Chinese before the English delivery.

One student of the Year 2020 suggested:

"The teacher had better introduce the main content in Chinese first and then deliver knowledge in English so that students can have a better understanding of the new knowledge; otherwise, students might feel discouraged when learning brand new and challenging content."

Surveys also indicate that students think they can learn some useful engineering knowledge from their peers' presentations and each student's report is unique in perspective and content. Students assume making presentations enables them to develop research ability and presentation skills. The surveys also indicate that what limits their learning knowledge from others' reports is caused by the following factors: audience are not as familiar with the presentation content as the speaker; English delivery is not as easy to understand and learn information as Chinese; speech time is usually limited within 15 minutes. Some students indicate they prefer students making presentations on some specific aspects or applications rather than a general introduction.

4.2.2 Adopting Production-Oriented Approach to Improve Teaching Effectiveness in Stage 2

Based on the above analysis of teaching effectiveness and students' feedback, we improved the teaching methods in 2021. (1) The teaching objective and significance of learning engineering knowledge and terms was emphasized from time to time. (2) Production-Oriented Approach by Wen (2016) was adopted to teach specialized knowledge and terminology. Translation assignments were sampled by sending the lecturer before class discussion so that the teacher could know the problems in students' translation. (3) Vocabulary list of each unit was provided to the students for previewing and reviewing. (4) We offered oral presentation PowerPoint models, evaluation criteria, useful resource websites, etc. Students' presentation PowerPoint was sent to the lecturer to view so as to obtain feedback and guidance before it was made in class. (5) The main teaching language was English but Chinese was used whenever necessary after English delivery, e.g., when teaching a term or discussing translation. (6) Some of the texts were assigned for students to read before class to strengthen their specialized reading competence.

Wen (2016) points out that production in POA includes translation and interpretation. There are three principles in POA approach: Learning-centered principle, Learning-using integration principle and Whole-person education principle. Learning-centeredness is superior to the student-centeredness in terms of the teacher's objective-oriented teaching planning, organization and guidance. Learning-using integration principle emphasizes the close connection of learning and using so as to acquire the targeted linguistic competence. Whole-person education principle aims at the development of students' all-round development. There are three hypotheses in Wen's POA: Output-driven hypothesis, Input-enabling hypothesis and Selective learning hypothesis. Outcome is the learning drive or motivation. Input must be purposedly selected so that it could enable students to acquire the targeted linguistic ability — "Functioning as enablers, receptive activities such as listening and reading must provide students with relevant ideas, linguistic expressions, and discourse structures." (Wen, 2016). In our context, we selected reading materials and offered vocabulary list which contain terminology and knowledge required for engineering translation. In the course of teaching, we emphasized some key specialized terms or discourse structures in order to scaffold students to be able to employ in the translation assignments.

In contrast to the students of the previous years, we could observe that students of 2021 showed greater motivation in learning this course and accomplished the learning and assignments with high quality. Most of the

students' oral presentations were well prepared and presented. Students consulted a range of resources: Wikipedia, Baidu, Bilibili, YouTube, CNKI, Google, Bing, WeChat, the library, textbooks, etc. The areas of improvement also include the logic of reports and the English-speaking ability. In 2021, some new topics were explored, such as remote sensing, artificial neural network and their applications, fuel cells, virtual instrument and LabVIEW, Forth Bridge, etc. By making oral presentations, students developed their information literacy, academic presentation skills, and critical thinking ability.

Vocabulary test scores indicated that students in 2021 performed much better than those in 2019. Vocabulary test includes 100 specialized terms or phrases and the total score is 100. There were 10 MTI students in 2019 and 11 in 2021. 6 students' scores were between 80-90 while 1 was above 90 in 2019; in contrast, 3 students' scores ranged between 80-90 while 6 were above 90 in 2021.

At the end of the fall semester in 2021, we administered an anonymous survey to students by Wenjuanxing. We received 10 responses out of the 11 students. 7 Students assumed their learning achievement was "significant", 3 assumed "much".

To address the significance and effectiveness of the course, the authors will compare students' translations with reference answers:

(1) 由于混凝土的抗压强度高而抗拉强度低，素混凝土通常在受拉区开裂而突然破坏。为了增加素混凝土的强度，通常都是将钢筋布置在受拉区，从而有了钢筋混凝土的问世和应用。

Translation by the student of 2019:

Due to the high compressive strength and low tensile strength of concrete, plain concrete beams are usually cracked in the tensile zone and suddenly destroyed in the tensile zone. To increase the strength of plain concrete beams, rebar is usually arranged in the tensile zone, which contributes to the appearance and application of reinforced concrete.

Reference translation:

Due to the high compressive strength and low tensile strength of concrete, plain concrete beams usually crack and fail suddenly in the tension zone. To augment the strength of such plain concrete beams, it has become customary to embed steel reinforcement in the tension zone, and hence the emergence and utilization of Reinforced Cement Concrete.

Translation by the student of 2021:

Due to the high compressive strength and low tensile strength of concrete, plain concrete beams usually crack and fail suddenly in the tensile zone. To increase the strength of plain concrete beams, a common practice is to embed steel reinforcement in the zones under tension, so there is the appearance and application of reinforced cement concrete.

(2) 实验室试验表明:当混凝土梁受到纯弯作用时，随着弯矩的逐渐增加，梁将发生挠曲，产生裂缝，中 性轴上移，钢筋达到屈服，最终因梁最外缘混凝土纤维出现过大的压变而破坏。

Translation by the student of 2019:

Experimental results show that when the concrete beam is subjected to pure bending, with the increase of bending moment, the beam will deflect. Meanwhile, cracks will occur, the neutral axis will move up, the steel bar will yield, and finally the concrete fiber at the outermost edge of the beam will be destroyed due to excessive compression.

Reference translation:

Laboratory tests indicate that when such a reinforced concrete beam is subjected to pure flexure, and the applied moment is gradually increased, the beam will deflect, develop cracks, shift its neutral axis, develop yielding of reinforcement and eventually fail due to excessive compressive strain in the extreme fibers.

Translation by the student of 2021:

Laboratory tests show that when a reinforced concrete beam is under pure flexure, and the bending moment gradually increases, the beam will deflect, crack, move up its neutral axis, reach the yielding point of reinforcement and eventually break due to excessive compressive strain at the outermost edge of the beam fibers.

From the above examples, we can see that it is essential for the course to foster students' awareness of using technical English sentence patterns and terms to perform translation. In contrast to Chinese sentence patterns, technical English sentence patterns are usually long and complex. Translation exercises and the reference

answers are given based on the specialized English textbook (Lei & Yuan, 2010). Answers given by the students of the Year 2021 indicate that some students were able to use terminology to perform translation, such as "embed reinforcement" "fail" "compressive strain" and also improved in sentence pattern (parallel verbs instead of short sentences). This is achieved by the lecturer's introducing and emphasizing specialized knowledge and terms in teaching, guided by the Production-Oriented Approach (Wen, 2016). With numerous translation practices designed in the course, students' awareness of using technical English patterns and terms has been cultivated and enhanced. This can be observed by analyzing students' translation in recent years.

5. Discussion

Final term vocabulary test consisted of 100 terms or phrases to be translated from English to Chinese. In the first three rounds of teaching, 2017, 2018, and 2019, both the lecturer and students mainly spoke English. In the year 2020, based on the students' suggestions, the lecturer occasionally spoke Chinese to make sure students understand and allowed students to speak English and Chinese when making presentations. The authors found that although Chinese made it easier for students to understand and learn information from their teacher's and peers' reports, the vocabulary tests showed that the average test scores declined slightly in 2020. We found that speaking Chinese may affect language acquisition.

The decline of vocabulary test scores in 2020 may be caused by the reduction of English input in class or by the students' individual factors — most students were of Liberal Arts backgrounds with no engineering foundation, or some students' English foundation was not very good originally.

This finding suggests that both the teacher and the students should insist on speaking English primarily for the purpose of language acquisition. This has also been discussed by other teachers (Kirschner, & Wexler, 2002), "facilitates vocabulary re-entry", "valuable for language learning", "to require English for both oral and written activities". Besides, the teacher should emphasize some core vocabulary repeatedly and give students a vocabulary list to learn or review so that they can master specialized vocabulary effectively.

Concerning code-switching, we assume that in an EMI class, English is the primary language, but it should not exclude the use of L1. In other words, L1 is justified when it is essential to make clear the equivalent of some English content in L1. This may involve several situations: the teaching content is very complex to understand or to express in English; teachers need to let students know the exact equivalent of some content, e.g. a term or a concept; for the purpose of translation skills, e.g., students need to compare the source language with the target language. The principle should be keeping English as the primary language and switching to L1 when it is justified. The advantage of speaking English in facilitating language learning, the legitimacy of L1, and the need for further research on code-switching in EAP class in EFL contexts have also been suggested by other study (Kirschner & Wexler, 2002).

6. Conclusion and Implications

This course is an innovative EAP course in terms of teaching objectives, content and teaching pedagogy. With adequate preparation, effective scaffolding and improvement over the years, the course has achieved its main objectives as originally designed and the teaching effectiveness has been improved constantly. The lecturer's professional development has been greatly enhanced by facing the challenge positively and learning new knowledge constantly. With the reasonable course design and the lecturer's guidance, the students' autonomous learning ability has enhanced and developed; the oral presentations are mostly subject-specific and informative; the quality of the translation assignments and reading reports are being improved gradually and effectively. The course is an EAP course for MTI program. We believe that the design and the teaching practice of this course also have implications for other EMI or EAP courses.

There are a few areas which need to be improved in the future: improving the lecturer's EMI proficiency, keeping informed of the latest developments in the subject areas, making use of technology in pedagogy, improving teaching effectiveness.

CRediT Authorship Contribution Statement

Wang Binhong: methodology, survey data collection and analysis, specific design of the course, selecting textbooks, implementation of teaching, original draft writing, revision

Zheng Shuming: designer of the 2016 HIT MTI Curriculum and the course *"Introduction to Engineering Knowledge and Its Translation"* — four modules, and the manuscript proofreader and reviser

Acknowledgements

We sincerely thank the anonymous reviewers for their constructive feedback and concrete suggestions on the revisions of our manuscript, as well as other people who have offered proofreading and suggestions. Wang Binhong would also like to owe her thanks to School of English, The University of Sheffield, where she visited during 2018.9-2019.9.

Funding

We declare no funding associated with the work submitted for publication.

Conflict of Interest

We declare no potential conflict or competing interest associated with the work submitted for publication.

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