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Addressing translation challenges of engineering students

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ABSTRACT: The current study examines technical translation challenges and the effect of a scaffolding project scheme implemented in experimental groups in a Russian university. Considering translation skills as a professional tool of a top-ranking engineer, the study provides a pilot four-componential model aimed at cultivating technically relevant environment for a Generation Z student and fostering translation skills of future engineering specialists. The purpose of the study was to delineate the principal challenges and develop sequential steps to overcome them. In an experiential design, two experimental groups of Bachelor and Master's degree students have been instructed in accordance with the offered scheme. The authors assessed students' performance and examined the efficacy of the model through an eight-month study. As the results show, it has proved to be a well-designed tool that can facilitate the translation process and assist in overcoming the challenges, as well as enhancing translation competence.

Keywords: Technical translation, translation challenges, scaffolding, metacognitive activity

INTRODUCTION

Addressing technical translation challenges of engineering students requires some understanding of the translation process and its impact on cognition, motivation and performance of future engineering specialists. The present study intends to highlight the necessity to foster translation skills among engineering students and underline various challenges technically-minded learners face while taking English for Specific Purposes (ESP) and English as a medium of instruction (EMI) courses.

University-educated, high-skilled engineering workforce with proficient knowledge of foreign languages is in demand in a globalised world with knowledge-based economies. People skilled in practical, industrial or mechanical arts can be referred to as technically-minded, thus, possessing a high degree of technical skills. They have a strong aptitude, a natural gift for technology, and are expected to bring together the knowledge learned through structured technology training and real-world experience. Acquired translation competence exponentially increases their chances for success in the professional domain.

LITERATURE REVIEW

Intrinsically, the concept of translation, technical rendering, in particular, and the issue of equivalency are among the most vexed questions widely discussed in *the fledging discipline known as Translation Studies* [1]. According to Catford, translation may be defined as the replacement of textual material in the *source language* (SL) by equivalent textual material in the *target language* (TL) [2]. Thus, …*equivalence implies the equality between the source text and the target one for an adequate translation* [3]. When rendering a written text, translators are not limited by a certain period of time: they can return to any phrase of the text at any time, solve any linguistic issue and, as a result, …*achieve the maximum level of equivalence between the original and the translation* [4]. The point should be made that since translators' activity is limited by the text, and they are to *render all the information contained in it* [5], it is essential for a student to develop an ability for …*the addition or omission of words from the original which is permissible provided it gives greater clarity of thought* in a scientific domain [6].

With the traditional approach of teaching translation known as *read and translate* [7], engineering students, some of them sought-after specialists in the future may find it impossible to master their linguistic skills. The training should

prepare them to become *a mediator* of language and engineering science, the one who is able to handle the diversity of perspectives and adapt the content to the target language. The skill requires specialised training, due to the specific function of scientific discourse. The concept of technical translation implies cross-cultural bilingual encoding and decoding of technical domain texts, and requires specialist knowledge of the area involved, so as to eliminate terminological confusion. A novel methodology of training engineers to improve their performance in technical translation has been developed with respect to currently available means [8][9].

The process of language mastering should be inextricably linked to translating competence. Future engineers should be able to comprehend professionally important information in a foreign language and produce it in a target language. As it appears …*both students and teachers consider the translation of a text in the specialty to be the most difficult part of the final exam in a foreign language* [10].

Technical texts are deemed to be informative [11] and confined within the subject boundaries. The analysis of technical documentation presupposes various challenges, one of which is a technical domain. Working with texts in their specialty, students have to deal with a large number of unfamiliar words that are difficult to memorise, since such texts contain a lot of specialist terms [12], derivative words, phraseological units, abbreviations [13], as well as metaphors [14][15], that *perform the functions of terms* [16]. There is a view that *translation is art based on knowledge* [17]. Lack of professional knowledge; namely, the incompetence in the engineering area is one of the major challenges facing a technically-minded student who is carrying across a career-related text from one language into another.

Unawareness of terminology definitely paves the way for inadequate translation. When working with the vocabulary of scientific and technical literature, the main difficulty in rendition seems to be posed by multi-component, highly specialised terms created lexically and syntactically, i.e. phrases formed according to certain patterns. Sometimes it is not just the misunderstanding of terminology that impedes translation. It could be a grammatical construction that becomes the problem. It is known that the scientific style is characterised by the frequent use of participial and adverbial expressions, impersonal constructions in the passive voice, as well as complex and compound sentences. In some languages, the rendition of infinitive and gerundial constructions causes a certain difficulty.

Problems in translation also occur due to the ignorance of connective devices. As a result, the logical flow of ideas in the translation may be violated.

Of particular importance is the consideration of the register, viz. the context in which a text is situated. It is configured through field (i.e. the institutional setting where a language is used), mode (that is the media of communication adopted), and tenor (i.e. the participants' relationship).

To achieve the adequacy of the rendition, a variety of translation transformations can be used. Each case of non-equivalence of structures requires a certain transformation that is usually considered as a challenge in translation. The instructor should assist engineering students in studying the means and ways of translating technical texts from one language to another, in learning how to overcome translation problems and how to achieve adequacy in rendition.

All these translation challenges can have pragmatic solutions. When dealing with such issues in technical translation, engineering students should draw from their already acquired knowledge, and be provided with extensive practice in rendition.

MATERIALS AND METHODOLOGY

Students of Saint Petersburg Mining University, Russia, start an ESP course during the second year of their studies without much knowledge in the technical domain. However, technical translation requires the understanding of not only linguistic structures in decoding the text, but also a considerable amount of domain knowledge.

To achieve a high standard of translation accuracy among Bachelor and Master's degree students, it has been decided to reorganise the educational process of technical translation training within the ESP course. The change was due to the well-tailored scheme of language learning in most universities based on delivering some basic linguistic competencies to develop communication skills, but not sufficiently addressing translation competence [18].

Forty-eight Bachelor programme students aged 19-20 years (30 males and 18 females) and 37 Master programme learners aged 21-22 years (23 males and 14 females) from Mining, Civil Engineering, Oil and Gas Engineering and Mining Processing faculties of Saint Petersburg Mining University participated in this study. The experiment covered the second year of study (3rd and 4th semesters of the Bachelor programme) and the first year of study (1st and 2nd semesters of the Master programme).

The researchers assumed field-related knowledge accumulation and integration during the period of two years of study in Russian and English for the Bachelor programme students, and during the period of four years of study for the Master programme learners. During the first week of the semester, the students of both groups were asked to perform an entrance test that measured their aptitude in technical translation, and to fill in a questionnaire aimed at identifying

the challenges of technical translation faced by learners immediately after completing the test. The questionnaire was prepared with a 10-point Likert scale and was distributed during the first and the last week of the academic year (after completing the course of technical translation).

In order to improve their translati0n skills, the students were offered a developed scaffolding project scheme and a planned and organised set of technical texts selected according to the course goal. The key steps were modelled as part of the ESP course. The scaffolding model is based on four main components:

1. Intrinsic motivation to complete the tasks and improve the language learning;
2. Technical domain material;
3. Declarative knowledge about translation techniques;
4. Set of translation assignments.

Motivation influences the way linguistic and professional competence including the ability to translate is fostered. In the current study, the concept of motivation is defined as …*a set of internal and external motive forces*, a focus on a certain goal [19]. It compensates for deficiencies in translation or professional knowledge engaging intellectual curiosity, perseverance, rigor, discipline, self-efficacy and the knowledge of personal limitations. Moreover, adapting the model to new generation requirements, it is necessary to organise the translation course in accordance with the peculiarities of Generation Z.

Generation Z, a predominant focus of this study, has numerous features that have to be taken into consideration. They are more technologically savvy, work at their own pace, require feedback from a course instructor and may get easily anxious while performing the task [20]. They have their unique worldview [21]. Being entrepreneur-driven and goal-oriented, they need to be surrounded by a supportive learning environment that will help acquire professional and linguistic competencies, so as to succeed in their professional sphere. Their aspirations and goals are realised through ample opportunities to interact with foreign colleagues and exchange technological information relevant for the professional growth.

Given implicit and explicit knowledge about translation techniques [22], methods and procedures to be selected, the model explains to the future engineer how to manipulate the text, so as to register the linguistic and cultural differences in the technical domain of the target language. Technical translation is constrained by the exigencies of communication in a vocational domain. Therefore, students should have relevant engineering knowledge, including the understanding of highly specialised engineering terms. The scaffolding scheme to facilitate the translating process is presented in Figure 1.

Figure 1: Scaffolding scheme of effective technical translation for engineering students.

To transfer messages between the linguistic and textual systems of both source and target languages, the scaffolding translation process includes the following steps:

1. Material. In addressing the challenges of technical translation, a predominant focus should be placed on the material to include in the ESP course. As the primary aim of the technical translation is to convey the original content, the material should be within the scope of knowledge of the student's major.
2. Engineering domain. The study is based on the assumption related to the particularities of technical translation, one of which is the lack of specialist knowledge when the ESP class is held for 2nd year Bachelor's degree students. The factor that predominantly contributes to a successful translation is the technical professional profile of the translator. In the authors' opinion, 2nd year students are not professionally equipped to understand the initial content of the study material, which is not the case with Master's degree students. One possible solution for overcoming this difficulty is to offer the material in accordance with the career-related course curriculum only, thus working in collaboration with content instructors.
3. Text. Inasmuch as dealing with the whole text on a macro-level is highly challenging for a novice translator, text segments assist in rendering the information-bearing text, allocating discourse analytic categories, set of semantic frames, grammatical structures to retrieve the content embedded in them.
4. Translation techniques. Working directly with a technical text (a text segment), special attention should be paid to the appropriate method of rendering it. The student should be able to analyse the linguistic structures representing the content at a level of considerable detail. Processing linguistic structures at the extent needed for receptive and productive competence presupposes that a student has a good understanding of translation techniques, as the language is subject to polysemy, synonymy and hyperonymy. The techniques are required to map the conceptual organisation of text segments.

5. Metacognitive activity. Mental process of translation, metacognitive monitoring is implemented to verify logical inconsistencies of the translation offered in the target language. Scaffolding promotes metacognitive activities, thus improving translation achievements. Research also showed that well-devised scaffolds enable students to acquire the appropriate skills that can be successfully used in new situations [23].

A set of subject-related assignments was compiled into a learning guide including the tasks when the students had to deal with industrial and technical literature; namely, for this study, with the documents for industrial purposes (technical guides, catalogues of machine and devices, manuals). The Bachelor's degree students were engaged in the written translation of the description of a technical device, whereas, the Master's degree students carried out the translation of a manual (operational instruction) of a technical device.

RESULTS

After completing an eight-month course of technical translation with the devised scaffolding model, the students performed an exit test that has been implemented to assess the learners' skills pertaining to the translation of career-related texts at the end of the semester. The test was followed by a questionnaire on the challenges faced by the students after the completion of the course. Figure 2 depicts a comparative analysis of the students' clear-cut responses immediately after the entrance and the exit technical translation tasks. The scale is from 0 (no deficiency in knowledge) to 10 (lack of understanding, and as a consequence challenges for translation).

The data obtained before the translation training course were analysed, the results scrutinised and discussed. The recommendations for the rectification of the lack of knowledge and the improvement of translation skills were provided and considered in the course.

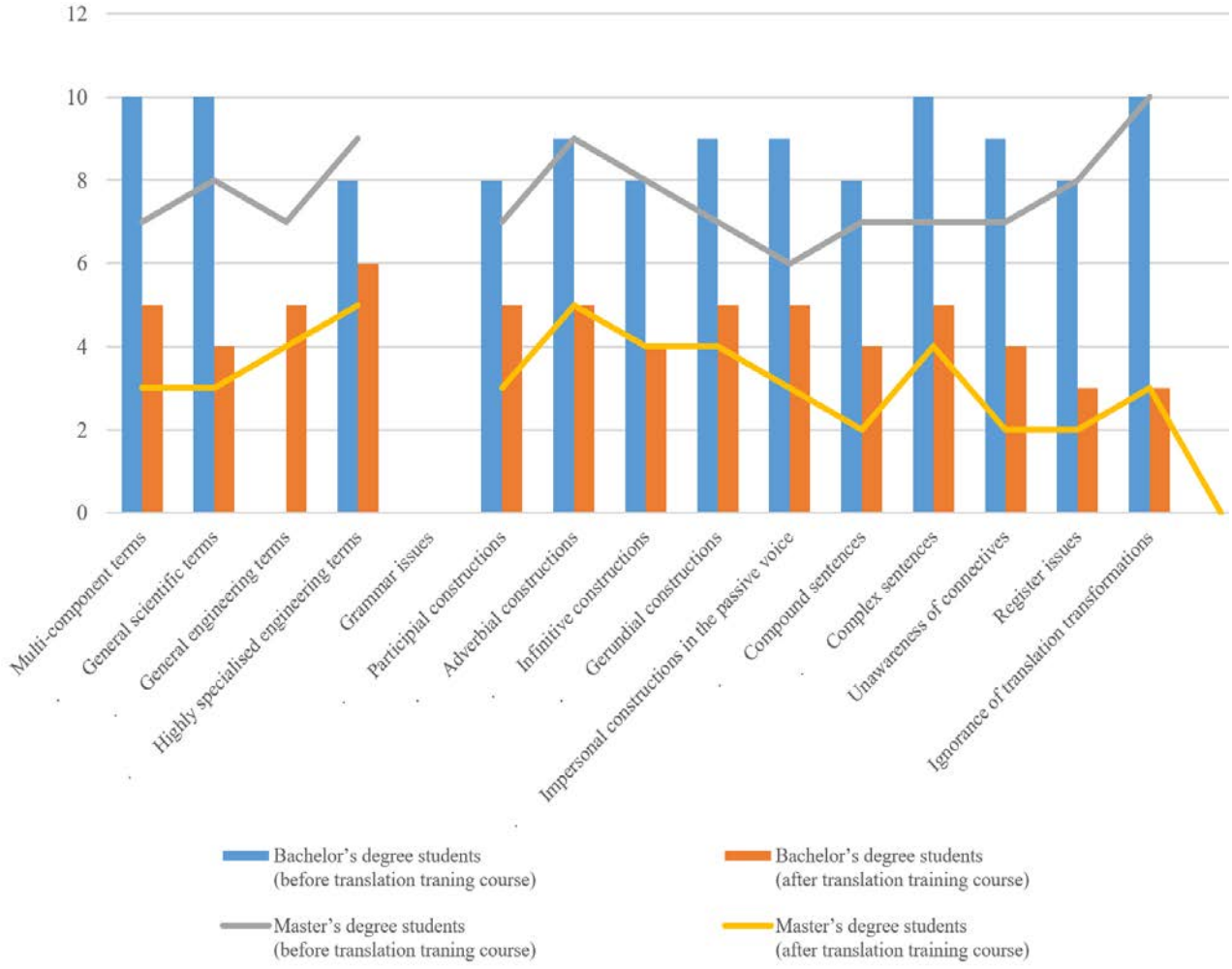

Figure 2: Comparative analysis of translation challenges among Bachelor and Master's degree students.

As is evident from Figure 2, there is a chasm between the results of Bachelor and Master's degree students before and after the training course due to the lack of knowledge in the engineering domain, that is followed by the ignorance of terminology of general engineering terms and highly specialised engineering terms. Most of the respondents expressed a desire to acquire technical knowledge simultaneously with translation techniques. In this context, a collaborative learning continuum was offered, where the material from the ESP course of Bachelor's degree students is selected in accordance with their engineering course.

Translation tasks were assessed according to the following criteria, with the highest score equalling 100%:

- Accuracy - accurate and complete rendition of meaning at word/phrase/sentence level that involves the correct use of lexical units, correct use of grammatical categories, as well as the omission or addition of information resulting in a partial or complete loss or change of meaning (30%).
- Adequacy - compliance with the standards of the target language (30%).
- Clarity and conciseness of presentation (20%).
- Style - suitable linguistic expressions, readability and appropriate register (20%).

Table 1: Assessment of translation tasks before and after the training course.

Assessment criteria	Bachelor's degree students (before the translation training course), %	Bachelor's degree students (after the translation training course), %	Rate of improvement %	Master's degree students (before the translation training course), %	Master's degree students (after the translation training course), %	Rate of improvement %
Accuracy	15	24	9	19	28	9
Adequacy	20	27	7	21	29	8
Clarity and conciseness of presentation	11	17	6	13	19	6
Style	10	18	8	14	20	6
Total	56	86	30	67	96	29

As can be seen from the table above, the identified issues at the beginning of the semester (accuracy, adequacy, clarity and conciseness of presentation, style) were significantly improved due to the scaffolding model incorporated within the ESP course. Namely, the rate of improvement for the Bachelor's degree students is 30%, whereas, the rate of improvement for the Master's programme learners is 29%.

CONCLUSIONS

The study illustrated the effectiveness of a pilot four-componential scaffolding model in the ESP course. The study was undertaken with the aim to foster technical translation skills among engineering students, which has proven feasible. In order to rectify the lack of specialist experience and consequently the lack of knowledge in the technical domain among Bachelor and Master's degree students, two experimental groups were trained in accordance with the scaffolding scheme. The texts given to the experimental groups were in general alignment with real-life situations in the professional sphere.

Assessment and questionnaires have been considered as the key criteria to illustrate the effectiveness of the devised model. The students faced challenges they responded to while completing a translation test before and after the eight-month course. Given that one of the challenges concerns the lack of knowledge in the engineering domain, the material provided should be aligned with the practical real-world translation experiences. Moreover, as rendering tasks are an effective method to provide career-immersion for technically-minded students, this area certainly demands further attention.

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